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Preliminary Survey of a Paleocene Faunule from the Angels Peak Area, New Mexico

BY

ROBERT W. WILSON

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Preliminary Survey of a Paleocene Faunule from the Angels Peak Area, New Mexico

By

ROBERT W. WILSON

INTRODUCTION

Angels Peak stands on the eastern rim of a large area of badlands carved by a tributary of the San Juan River from Paleocene strata of the Nacimiento formation, and presumably also from Wasatchian strata of the San José (Simpson, 1948). This area of badlands lies some twelve miles south of Bloomfield, New Mexico in the Kutz Canyon drainage. Angels Peak (Angel Peak of Granger, 1917) and Kutz Canyon (Coots Cañon of Granger, and of Matthew, 1937) are names that have been applied to the location (figure 1).

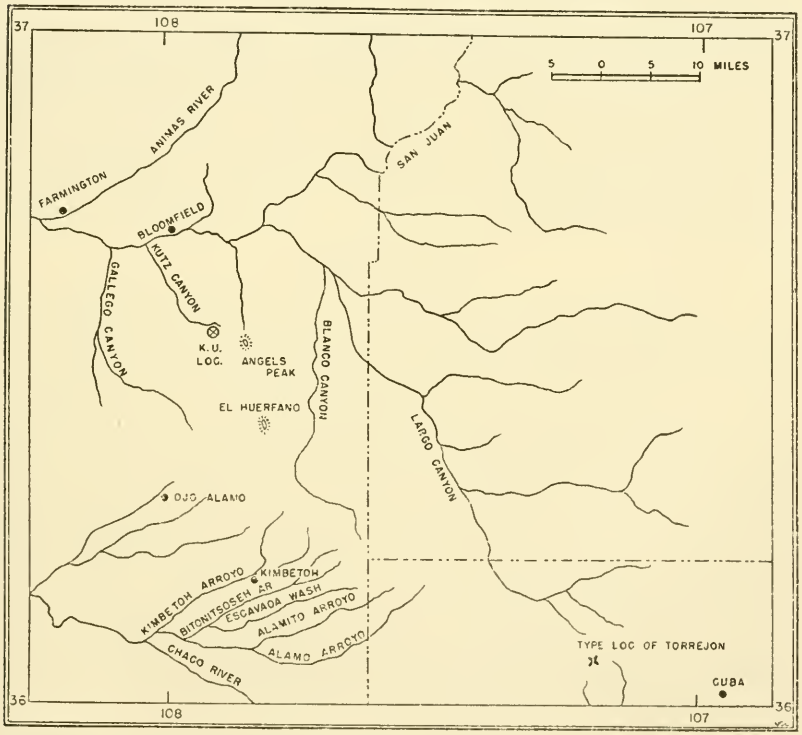

FIGURE 1. Map of a part of the San Juan Basin, New Mexico, showing location of University of Kansas fossil locality west of Angels Peak.

E. D. Cope's collector, David Baldwin, possibly worked in this area in the Eighties. The first published record, however, of mammalian fossils from the Angels Peak badlands was made by Walter Granger in 1917 as a result of his field work in the preceeding summer. Granger obtained specimens, usually poorly preserved, but occasionally rather abundant locally, from various levels up to within 150 feet of the western rim of the badlands basin. This collection was obviously of Torrejonian or middle Paleocene age. In the 1917 report, Granger gave as a faunal list the following species:

Tetraclaenodon
Mioclaenus turgidus
Periptychus rhabdodon
Anisonchus sectorius
Protogonodon sp. nov.
Tricentes
Deltatherium
Psittacotherium

To this list should be added *Triisodon antiquus,* a specimen of which is stated by Matthew to come from Kutz Canyon in his monograph (1937:80) on the Paleocene faunas of the San Juan Basin.

In the summer of 1948, a field party from the University of Kansas was fortunate in finding a local concentration of rather well preserved material at the western edge of the badlands at Angels Peak. Because it probably will be some time before a full account of this faunule can be prepared, it is thought advisable, preliminarily, to give a general statement as to occurrence, and tentatively to list the species.

OCCURRENCE

The mammalian fossils, numbering approximately 150 specimens, were all obtained within a small area located in the NW¼ of sec. 14, T. 27 N, R. 11 W, San Juan County, New Mexico. The specimens were collected from a zone of reddish silt three to four feet in thickness. The actual bone layer, not as yet located, may prove to be thinner than this. Almost all the material was recovered from approximately 100 linear yards of outcrop. A few specimens, however, were obtained at varying distances away from this central area, as far distant perhaps as one-half mile. Of these, nineteen were at the same level stratigraphically, and only one was lower (by 70 feet) in the section. This latter specimen, representing a new genus and species of Primates, is not certainly duplicated by material at the main concentration. Seemingly, the others are.

The red zone at the "bone pocket" carries many concretionary masses which frequently contain the fossil specimens. Not all specimens, however, are from such lumps.

Even within the area of greatest concentration, specimens are of sporadic occurrence. A low ridge, a few feet high, may have abundant material weathering from the rock on one slope, but have the opposite side barren. Occasionally, a small rill three or four feet in length and six inches or so across may carry fragments of five or six individuals representing several genera. For example, in one such rill were found *Didymictis*, n. sp. b; *Goniacodon levisanus; Tricentes* cf. *T. subtrigonus;* and *Protoselene opisthacus.* No specimens were found in place in unweathered rock, but the quarry possibilities of the bone pocket have still to be tested.

The stratigraphic position of the bone concentration in relation to the total Nacimiento section exposed in Kutz Canyon has not been determined. It is approximately 160 feet below the western rim at a point nearest the "pocket". The upper 100 feet of strata consists of sandstone believed by Granger (1917:822) to represent either: (1) equivalent of the "Wasatch" (San José) of the Ojo Alamo section, or (2) "Torrejon" (upper Nacimiento). Granger perhaps favored the first interpretation, but the writer, at present, thinks the second probable.

THE MAMMALIAN FAUNULE

The following mammalian species have been identified as present in the Angels Peak "pocket".

Order Multituberculata
  Family Ptilodontidae
    Mimetodon? cf. *M. trovessartianus*
Order Insectivora
  Family Palaeoryctidae
    Palaeoryctes cf. *P. puercensis*
  Family Leptictidae
    Prodiacodon? sp.
  Family Pantolestidae
    Pentacodon n. sp.
  Family Mixodectidae
    Indrodon malaris
Order Primates
  Family Anaptomorphidae
    anaptomorphid? new gen. and sp. (70 feet stratigraphically below level of Angels Peak pocket).
  ?Primates, gen. and sp. indet.
Order Taeniodonta
  Family Stylinodontidae
    Psittacotherium? sp.
Order Carnivora
  Family Arctocyonidae
    Tricentes cf. *T. subtrigonus*
    Chriacus truncatus
    Chriacus nr. *C. baldwini*
    Deltatherium fundaminus?
    Claenodon n. sp.
    Triisodon? sp.
    Goniacodon levisanus
  Family Miacidae
    Didymictis n. sp. a
    Didymictis n. sp. b
Order Condylarthra
  Family Hyopsodontidae
    Mioclaenus turgidus
    Ellipsodon cf. *E. inaequidens*
    Ellipsodon acolytus
    Protoselene opisthacus
  Family Phenacodontidae
    Tetraclaenodon nr. *T. puercensis*
  Family Periptychidae
    Coriphagus cincinensis
    Anisonchus sectorius
    Periptychus nr. *P. carinidens*

ANGELS PEAK CENSUS

The total number of specimens for each member (species or genus) of the faunule is tabulated in the list on the page facing, page 7. For the purposes of this list, census, a few of the isolated teeth have been counted as jaws. They were so counted whenever they seemed to be representative of separate, individual animals.

The census-count includes all of the specimens that were identified. The numbers in parentheses, on page 7, refer to those individuals that were found outside of the 100 linear yards or so of outcrop comprising the principal area of concentration of specimens.

	upper jaws (isolated)	lower jaws (isolated)	upper and lower jaws (associated)
Mimetodon? cf. *M. trovessartianus*	.....	1	.....
Palaeoryctes cf. *P. puercensis*	.....	.....	1
Prodiacodon? sp.	.....	1	.....
Pentacodon n. sp.	.....	2 (1)	.....
Indrodon malaris	.....	4	.....
Primates n. gen. and sp.	1 (1)	.....	.....
? Primates	.....	2	.....
Psittacotherium? sp.	1	.....	.....
Tricentes cf. *T. subtrigonus*	7	15	4
Chriacus truncatus	1	6	5 (2)
Chriacus nr. *C. baldwini*	.....	1	.....
Deltatherium fundaminus?	3	1	.....
Claenodon n. sp.	1	1	.....
Triisodon? sp.	1	.....	.....
Goniacodon levisanus	.....	2	.....
Didymictis n. sp. a	.....	1	1
Didymictis n. sp. b	1	3	.....
Mioclaenus turgidus	2	2	2
Ellipsodon cf. *E. inaequidens*	.....	3 (1)	.....
Ellipsodon acolytus	3	11	1
Protoselene opisthacus	3 (2)	3 (2)	2
Tetraclaenodon nr. *T. puercensis*	5 (2)	18 (2)	4 (1)
Coriphagus encinensis	.....	2	.....
Anisonchus sectorius	4 (2)	8 (2)	.....
Periptychus nr. *P. carinidens*	3 (1)	3 (1)	2
Totals	36	90	22 148

ENVIRONMENT

The faunal list is rather long for one obtained from such a restricted area. It is not exceptional in this regard, however, for even longer lists have been made from single quarry sites in the Paleocene (Simpson, 1937:33-34). The exact number of genera and species represented is still uncertain. It seems that twenty-one genera and twenty-four species are present and that they are distributed among eleven to twelve families and five to six orders. A greater number of genera and species may be recorded eventually.

The ferungulate cohort constitutes most of the fauna (91 percent), and this fact indicates a floodplain facies as the most probable depositional environment. The small representation of multituberculates, insectivores, and insectivore derivatives, however, may be attributed in part to the difficulties inherent in surface collecting of minute specimens.

Some resemblance in percentage composition is shown to the faunules of the Fort Union Group if those forms too small to be seen readily in collecting of surface material are omitted from the Montanan lists, but differences exist not entirely the result of either geographic or stratigraphic separation. Thus, the phenacodontids of the Angels Peak are relatively abundant, matching figures obtained for surface collecting in the Fort Union of Montana (Simpson, 1937: 61).

That the faunule is not completely of floodplain type is seen in the absence or rarity of such relatively large carnivores as *Claenodon ferox,* the larger species of *Chriacus, Triisodon,* and the entire absence of the Mesonychidae. The absence of the mesonychids might, but probably should not, be explained as a result of stratigraphic differences. There seems to be no reason for thinking that the Angels Peak faunule antedates the appearance of the Mesonychidae. They are absent from the Dragon and earlier levels, but are also extremely rare in the Lebo of the Fort Union Group. In the ungulate population, the absence of species of *Ellipsodon* other than *E. acolytus* (*E. inaequidens* is so rare everywhere that it hardly seems an exception to this statement), and the complete absence of *Haploconus* likewise suggest some, presumably local, peculiarity of environment. The latter genus is absent from the Lebo, but is recorded from the Dragon (Gazin, 1941:3), a fact which prevents attaching any age significance to its absence from the Angels Peak faunule. It should be mentioned, however, that no remains of *Haploconus* were reported as a result of the more extensive collect-

ing by Granger in the Angels Peak area. Incidentally, the type of *Haploconus angustus* is said to come from near Huerfano Peak (Matthew, 1937:156).

The high ratio of carnivores to ungulates is a peculiarity shared with, but far exceeded by, the Lebo fauna if figures obtained from surface collections of the latter are used. It seems unlikely that this ratio is the result of selective trapping in the accumulating sediments. Perhaps, this high ratio reflects the imperfectly carnivorous habits of the Paleocene creodonts as a group. One obvious explanation, regardless of probability or merit, is that some of these do not belong to the Carnivora.

The percentage composition of the Angels Peak faunule based on 148 identifiable mammalian specimens, is as follows:

		Percent
Insectivora		5
Carnivora:		
Arctocyonidae	32	
Miacidae	4	
		36
Condylarthra:		
Hyopsodontidae	22	
Phenacodontidae	18	
Periptychidae:		
Anisonchinae	10	
Periptychinae	5	
	15	
		55
Others		4
		100

The most common forms in the Angels Peak faunule are: *Tricentes* cf. *T. subtrigonus, Chriacus truncatus, Ellipsodon acolytus, Tetraclaenodon* nr. *T. puercensis,* and *Anisonchus sectorius.*

Post-cranial skeletal elements are of relatively rare occurrence in the pocket. The presence of several more or less complete skulls, and the relatively frequent association of upper and lower dentitions, however, seem to be points against ascribing the accumulation to the activities of predators and scavengers, otherwise perhaps indicated by the large amount of resistant tooth material.

AGE OF THE FAUNULE

The Angels Peak faunule, as Granger stated, is of Torrejonian age. This fact is clearly evident for the genera are all, with the exception of the forms referred to the Primates, represented in beds of that age elsewhere in the Nacimiento. Further, approximately two-thirds of the known "Torrejon" genera are recorded by specimens from the Angels Peak pocket. The primate remains present no evi-

dence for suspecting a difference in age, because the order is otherwise unrecorded in the Torrejonian of New Mexico. The species are in most instances identical or closely allied with those hitherto recognized. It is evident from this that the Angels Peak faunule is more closely correlated in time with the San Juan Torrejonian fauna as a whole than with either the Dragon fauna or the Tiffanian. In respect to the San Juan Torrejonian, closest resemblance is to the *Deltatherium* zone fauna rather than to the *Pantolambda* zone fauna (Osborn, 1929:62). The difference in the faunas of these two zones is largely, if not entirely, facial in character.

It is not clearly evident, however, that we are dealing with exactly contemporaneous assemblages when comparison is made between the Angels Peak faunule and the rest of the San Juan fauna which serves collectively to define the typical Torrejonian. It may be: (1) that the Angels Peak faunule is of slightly different age than the latter, or (2) that the latter is susceptible of stratigraphic subdivision, and the Angels Peak faunule marks one stage of a sequence in time. This problem will not be easily solved, and perhaps may never be, for concentrations similar to that of the Angels Peak faunule are of infrequent occurrence. It is beyond the scope of the present paper, and of the present stage of our knowledge of the "Torrejon" fauna, to discuss at length the possible difference in age, but the following remarks summarize the matter for the Angels Peak material.

Many of the Angels Peak specimens differ in minor ways from those previously described from the Torrejonian of the San Juan Basin. Some of these differences are sufficiently great for the recognition of new species. Other differences at present are not clearly valid on a specific level, and it may become necessary to restudy the entire fauna if satisfactory conclusions ever are reached.

A direct comparison can be made between the Angels Peak faunule, and a numerically smaller and less well preserved one obtained by the University of Kansas from a bone concentration near the head of Kimbetoh Arroyo. The latter faunule presumably is from the "*Deltatherium* zone," and hence does not occupy a demonstrably high position in the "Torrejon," rather, one seemingly down toward the first known appearance of the fauna. Closely related or identical species of nine genera occur at both localities. Of these, the specimens of one species seem to be indistinguishable; the specimens of another Angels Peak member are perhaps slightly more advanced; and seven include specimens, distinguishable in greater or lesser degree, which suggest, principally in smaller size, a less advanced stage for the Angels Peak faunule.

In general, the non-ferungulate part of the Angels Peak faunule seems to depart more widely from what is typical of the "Torrejon" fauna than do the Carnivora and Condylarthra. Because the former is very poorly represented in the faunule, and not too well known elsewhere in the San Juan Basin, it may be argued that the apparent differences would disappear with the acquisition of more material. This may be so, but at present the point can not be demonstrated.

It is not justified at present to maintain that the Angels Peak species occupy an earlier position in the Torrejonian than do those obtained from outcrops between Kimbetoh and the heads of the two forks of Arroyo Torrejon. Indeed, the stratigraphic position of the Angels Peak pocket with a considerable thickness of Torrejonian strata beneath it, tends to argue against such a view. Nevertheless, it is possible, if not probable, that such is the case, or at least that detailed work would reveal a series of faunules of slightly different ages in the Torrejonian stage of the Nacimiento formation. Of course, chance in collecting, as well as geographic and ecologic differences, play their part in giving such a local faunule as that at Angels Peak its somewhat different aspect, but these factors may not account altogether for the observed differences.

LITERATURE CITED

GAZIN, C. L.

1941. The mammalian faunas of the Paleocene of central Utah, with notes on the geology. Proc. U. S. Nat. Mus., 91, no. 3121: 1-53, 3 pls., 29 figs. in text.

GRANGER, WALTER.

1917. Notes on Paleocene and lower Eocene mammal horizons of northern New Mexico and southern Colorado. Bull. Amer. Mus. Nat. Hist., art. 32: 821-830, 2 pls., 1 fig.

MATTHEW, W. D.

1937. Paleocene faunas of the San Juan Basin, New Mexico. Trans. Amer. Philos. Soc., n. s., 30: i-viii, 1-510, 65 pls., 85 figs. in text.

OSBORN, H. F.

1929. The titanotheres of ancient Wyoming, Dakota, and Nebraska. U. S. Geol. Surv., Monog. 55 (2 vols.): i-xxiv, i-xi, 1-953, 236 pls., 797 figs. in text.

SIMPSON, G. G.

1937. The Fort Union of the Crazy Mountain Field, Montana, and its mammalian faunas. U. S. Nat. Mus., Bull. 169: i-x, 1-287, 10 pls., 80 figs. in text, 62 tbls.

1948. The Eocene of the San Juan Basin, New Mexico. Amer. Jour. Sci., 246: 257-282, 363-385, 5 figs. in text.

University of Kansas, Museum of Natural History, Lawrence, Kansas. Transmitted July 1, 1950.

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Two New Moles (Genus Scalopus) from Mexico and Texas

BY

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Two New Moles (Genus Scalopus) from Mexico and Texas

BY

ROLLIN H. BAKER

In the spring of 1950, a field party from the University of Kansas Museum of Natural History including J. R. Alcorn, W. J. Schaldach, Jr., George Newton, and the author collected mammals in the Mexican state of Coahuila. A few days were spent in the Sierra del Carmen. One morning when examining sets for pocket gophers in these mountains, Alcorn found a mole caught in one of the traps. Subsequent examination discloses that this specimen belongs to a heretofore unknown species which may be named and described as follows:

Scalopus montanus new species

Type.—Male, adult, skin and skull plus body skeleton; no. 35668, Univ. Kansas Mus. Nat. Hist.; Club Sierra del Carmen, 2 mi. N and 6 mi. W Piedra Blanca, Coahuila, Mexico; 7 April 1950; obtained by J. R. Alcorn, original no. 11093.

Range.—Known only from the type locality; probably found in other localities in the Sierra del Carmen of northern Coahuila, Mexico.

Diagnosis.—Size medium and slender for the genus (see measurements); tail medium in length, sparsely covered with whitish hairs; claws of forefeet slender; upper parts near (h) Buffy Brown (capitalized color terms after Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912), with slight rufous wash on top of head; underparts resemble upper parts but slightly paler with longitudinal band of near (14) Sudan Brown extending from chin posteriorly to and around base of tail, less intense on breast; skull small, arched, and relatively slender especially across mastoidal region; posterior part of cranium depressed; foramen magnum low when viewed from rear; external pterygoid region not greatly expanded; teeth small, especially upper third molar.

Comparison.—From *Scalopus aquaticus,* of which ten subspecies have been seen including those of significant geographic position, *S. montanus* differs in: Skull slenderer, less angular and relatively narrower across mastoidal region; cranium arched with hind part flattened; external pterygoid region less expanded; teeth relatively small, especially last upper molar. From *S. inflatus,* known to me from Jackson's description (N. Amer. Fauna, 38:53-54, pls. 2, 3, September 30, 1915), *S. montanus* differs in: Skull less angular and slenderer, prelachrymal region not inflated; zygomata slenderer.

Remarks.—*S. montanus* is known from a single specimen, which represents the second known occurrence of the genus *Scalopus* in

Mexico. The other occurrence is that of *S. inflatus* in the state of Tamaulipas. *S. montanus* is geographically isolated in mountainous country from other species of *Scalopus.* Ten of the recognized subspecies of *S. aquaticus* were available for examination and descriptions of others were studied. It was found that the number and magnitude of the differences separating any one of these subspecies from an adjoining one was less than those separating *S. montanus* from *S. a. texanus* and *S. a. intermedius,* which are, geographically, closest to *S. montanus. S. montanus* seems not to be closely related to *S. inflatus* of Tamaulipas. *S. montanus* is given specific rank because of the great degree of difference between it and its nearest relatives, and because of its geographically isolated position.

The specimen of *S. montanus* was taken in a tunnel found by digging away a mound thought to be that of the pocket gopher, *Thomomys sturgisi.* A trap set in one direction in the tunnel caught the mole; a trap set in the other direction in the tunnel was later covered with soil, evidently by a gopher. After the capture a thorough inspection of the area revealed no "raised" tunnels, typical of *Scalopus.* A series of *Thomomys* was taken in this area in sets placed in tunnels found under similar mounds. This locality was near the headquarters of the Club Sierra del Carmen in a parklike stand of oak timber in a cañon, at an elevation of 4950 ft. as recorded by our altimeter. The plant association was judged to be characteristic of the Upper Sonoran Life-zone, not far below the beginning of the Transition Life-zone. The area was heavily grazed by goats, hogs and horses and had little grass or other ground cover under the trees. The soil in this cañon was not deep and consisted of a rocky, marly mixture, pale red in color, evidently produced by weathering of the reddish volcanic rocks bordering the cañon.

The Sierra del Carmen is a high, igneous range, surrounded for the most part by Lower Sonoran plains and desert. Zoologically, these mountains are poorly known. Few collectors have been in the area; most of these have been afforded accommodations through the Club Sierra del Carmen (Carmen Mountain Hunting Club), the members of which have been especially interested in assisting naturalists. Several kinds of mammals are known only from this "biological island" including the pocket gopher mentioned above and the shrew, *Sorex milleri.* The finding of a mole in the higher elevations of this range suggests that moles may occur in other mountainous areas of Mexico.

Assistance with field work is acknowledged from the Kansas University Endowment Association.

Measurements.—The adult, male holotype measures as follows: Total length, 150; tail vertebrae, 27; hind foot, 20; greatest length (of skull), 32.2; palatilar length, 13.8; mastoidal breadth, 16.2; interorbital breadth, 7.0; maxillary tooth-row, 11.3; greatest depth of skull including auditory bullae, 9.4; weight, 38.6 grams.

Specimen examined.—One, from the type locality.

In studying *Scalopus aquaticus texanus,* I noted that Allen (Bull. Amer. Mus. Nat. Hist., 3:221, April 29, 1891) based the original description on a single, unsexed specimen taken in Presidio County, Texas, by Wm. Lloyd in September, 1887. Later, Allen wrote (Bull. Amer. Mus. Nat. Hist., 5:200, August 18, 1893) that a series of moles from Rockport, Aransas County, Texas, agreed essentially with the type. True (Proc. U. S. Nat. Mus., 19:22, December 21, 1896) believed that the type was actually from Aransas County rather than Presidio County. This belief was shared by later workers. In checking the literature, I find that the collector of the type, Wm. Lloyd, who was obtaining specimens for George B. Sennett at the time, took other mammals in September as well as in October of 1887 in Presidio County (see Allen, Bull. Amer. Mus. Nat. Hist., 3:221, 223, 224, April 29, 1891) and birds there in June of 1887 (see Sennett, Auk, 5:43, January, 1888). I can find no evidence that Lloyd collected in or near Aransas County in 1887 and see no reason for doubting that the locality, Presidio County, as written on the original label of the type of *S. a. texanus* is correct. Mr. M. J. Carroll of the Texas State Historical Association advises me that in 1887, Presidio County was reduced to its present size by the creation of Brewster and Jeff Davis counties. Lloyd might have taken the mole in any one of these three Trans-Pecos counties. Even so, these counties are widely separated geographically from the range of other moles designated as *S. a. texanus* (see Davis, Amer. Midl. Nat., 27:386, March, 1942). The taking of *S. montanus* in the Sierra del Carmen immediately south of Trans-Pecos Texas leads me to think that Lloyd's mole might have been taken in a mountainous region within one of the three counties mentioned above. A description of *Scalopus aquaticus texanus* Allen follows:

Scalopus aquaticus texanus Allen

Scalops argentatus texanus Allen, Bull. Amer. Mus. Nat. Hist., 3:221, April 29, 1891.

Type.—Sex unknown, adult, skin no. 3488, skull no. 2740, Amer. Mus. Nat. Hist.; Presidio County, Texas; September, 1887, obtained by Wm. Lloyd.

Range.—Limits of range in Trans-Pecos Texas unknown.

Diagnosis.—Size small; rostrum heavy and broad; lower jaws heavy; palatine space wide with upper tooth-rows arched laterally; teeth large, especially fourth premolar and molars.

Comparison.—From adults of comparable age from Rockport, Aransas County, Texas, S. *a. texanus* differs in: Rostrum broader and heavier; lower jaws heavier; palatine space wider, with upper tooth-rows more arched laterally; individual teeth in both jaws larger, especially fourth premolar and molars. From S. *a. intermedius,* which is geographically nearest to the northeast (adult specimens from Meade, Clark and Barber counties, Kansas, and Dewey County, Oklahoma), S. *a. texanus* differs in: Size smaller; rostrum less massive and shorter; tooth-row shorter.

Remarks.—The type has been previously examined by True (*op. cit.* :44). The skin is faded and of little taxonomic worth. The anterior part of the skull is present along with both upper tooth-rows and most of the lower jaws. The teeth are well worn, indicative of old adulthood. In size, S. *a. texanus* appears closest to moles from southern Texas (Rockport) which previously were assigned to the subspecies *Scalopus aquaticus texanus.* The tooth-rows are of the same length, but the individual teeth of S. *a. texanus* are significantly larger.

The moles in southern Texas previously ascribed to *Scalopus aquaticus texanus* seem to be without a name and may be known as follows:

Scalopus aquaticus alleni new subspecies

Scalops texanus, Allen, Bull. Amer. Mus. Nat. Hist., 5:200, August 18, 1893.

Scalops aquaticus texanus True, Proc. U. S. Nat. Mus., 19:21, December 21, 1896.

Scalopus aquaticus texanus Jackson, N. Amer. Fauna, 38:50, September 30, 1915; Miller, U. S. Nat. Mus., Bull. 128:15, April 29, 1924; Davis, Amer. Midl. Nat., 27:386, March, 1942.

Type.—Male, adult, skin no. 7189, skull no. 5788, Amer. Mus. Nat. Hist.; Rockport, Aransas County, Texas; 29 January 1893; obtained by H. P. Attwater.

Range.—Southern Texas, north to Bexar County and east to Refugio County (see Davis, *loc. cit.*).

Diagnosis.—Size small; according to Davis (*loc. cit.*), " . . . length of hind foot seldom more than 19 mm.; total length seldom more than 140 mm. Skull small and flat, seldom exceeding 33 mm. in occipitonasal length and seldom equalling 10 mm. in depth; maxillary breadth usually less than 10 mm.; alveolar length of maxillary tooth row seldom more than 10.5 mm."

Comparison.—From S. *a. cryptus,* geographically adjacent to the east, S. *a. alleni* differs in: Size smaller; color paler; skull smaller and flatter. From S. *a. intermedius,* geographically adjacent to the north, S. *a. alleni* differs in: Size smaller; skull smaller and flatter with shorter tooth-row (see Davis, *op cit.:* 384, 385). For comparison with S. *a. texanus,* see account of that subspecies.

Remarks.—This mole is named in honor of Dr. J. A. Allen in recognition for his work on Texas mammals. Grateful acknowledgment is made to those in charge of the collection of Recent mammals in the American Museum of Natural History for permitting me to examine the moles from Aransas County and the type specimen of *Scalops argentatus texanus* Allen.

Transmitted January 15, 1951.

23-6626

Two New Pocket Gophers from Wyoming and Colorado

BY

E. RAYMOND HALL and H. GORDON MONTAGUE

University of Kansas Publications

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23-6627

Two New Pocket Gophers from Wyoming and Colorado

BY

E. RAYMOND HALL AND H. GORDON MONTAGUE

In the academic year of 1947-48 Montague studied the geographic variation in *Thomomys talpoides* of Wyoming. His study was based upon materials then in the University of Kansas Museum of Natural History. Publication of the results was purposely delayed until previously reported specimens from certain adjacent areas, especially in Colorado, could be examined. In the autumn of 1950 one of us, Hall, was able to examine the specimens from Colorado; also, the specimens from Wyoming accumulated in the past two seasons of field work in Wyoming were examined by Hall. A result of these studies is the recognition of two heretofore unnamed subspecies of the northern pocket gopher in southeastern Wyoming.

Grateful acknowledgment is made of the opportunity to study the Coloradon specimens in the Biological Surveys Collection of the United States National Museum, and of the financial assistance from the Kansas University Endowment Association which permitted the field work in Wyoming.

Descriptions and names for the two new subspecies are given below:

Thomomys talpoides rostralis new subspecies

Type.—Female, adult, skull and skin, no. 17096 Mus. Nat. Hist., Univ. Kansas; from 1 mi. E Laramie, 7164 ft., Albany County, Wyoming; obtained on July 16, 1945, by C. Howard Westman; original no. 320.

Range.—Southern Wyoming and south in the mountains of Colorado to the Arkansas River but not including the Colorado River drainage except in Grand County and part of Routt County.

Diagnosis.—Size medium (see measurements); upper parts ranging from between Cinnamon-Rufous and Hazel (capitalized terms are of Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912) in the eastern part of the range to between Argus Brown and Brussels Brown in the western part of the range; sides Cinnamon-Rufous; throat whitish; remainder of underparts whitish, in many specimens tipped with Ochraceous-Buff; feet and tail whitish; rostrum long; nasals ordinarily truncate posteriorly; temporal ridges nearly parallel; interpterygoid space broadly V-shaped.

Comparisons.—From *Thomomys talpoides clusius* (topotypes), *T. t. rostralis* differs in: Body longer; color more reddish (lighter with less brownish and more ochraceous); rostrum both longer and broader, actually and also in relation to length of the skull; skull broader interorbitally; upper molariform tooth-row longer; tympanic bullae less inflated. For comparison with *T. t. attenuatus* to the east, see the account of that subspecies.

From *Thomomys talpoides macrotis* (topotypes) to the southeast, *T. t. rostralis* differs in: Body shorter; upper parts slightly more ochraceous and less grayish; skull averaging smaller in all measurements except that interorbital region is broader and rostrum and upper molariform tooth-row are longer; nasals truncate versus emarginate, and consistently shorter; basilar length consistently less in specimens of equal age; mastoidal breadth less in 16 of 17 specimens of *rostralis;* temporal ridges parallel instead of divergent posteriorly; exposed parts of upper incisors shorter; tympanic bullae more angular anterolaterally.

From *Thomomys talpoides fossor* (specimens from Rico, Silverton, Hermit and Pagosa Springs, all in Colorado), the subspecies to the southward, *T. t. rostralis* differs in: Longer body; lighter color of upper parts; nasals truncate rather than rounded posteriorly; temporal ridges more nearly parallel (less divergent posteriorly); rostrum longer (averaging longer and broader); skull wider across zygomatic arches in 11 of 12 specimens of *rostralis.*

Remarks.—Geographic variation is evident in the material examined. In the initial study, one of us, Montague, separated the material from the Medicine Bow Range in Wyoming as a subspecies different from that at Laramie and the adjoining mountains to the eastward because of the darker color of the western animals and the smaller size of males. Acquisition of more material from still farther west (Sierra Madre) in Wyoming and the examination of material in the United States Biological Surveys Collection from Colorado discloses that there is a cline of increasing intensity of color from the geographic range of *T. t. cheyennensis* at Pine Bluffs, Wyoming, westward to the eastern side of the Sierra Madre at a locality three miles east and five miles north of Savery, Wyoming. A further deterrant to setting apart the animals of the Medicine Bow Mountains as a separate subspecies is the large size of males from the North Platte River Valley southeast of Saratoga. The males from the valley of the North Platte are intermediate in size between those from the Medicine Bow Mountains and those from the Laramie River Valley. Females from the same places are available in longer series and show less variation. If there is a difference in size in the females, those from the mountains are larger than those from lower elevations on either side.

The examination that one of us, Hall, has made of the related materials from Colorado reveals, as we supposed would be the case,

that a large area formerly assigned to the geographic range of *Thomomys talpoides fossor* is to be assigned to the geographic range of the newly named *Thomomys talpoides rostralis*. It should be added that, at this writing, the lack of ideally complete material from southwestern Colorado leaves some doubt as to the range of variation properly to be included within the geographic range of *T. t. fossor*. Consequently, study of a larger number of specimens from more localities in Colorado may show that the boundary between the geographic ranges of *T. t. fossor* and *T. t. rostralis* should be shifted from where we have tentatively placed it.

Specimens examined.—Total number, 168. Unless otherwise indicated, those from Colorado are in the United States National Museum, Biological Surveys Collection, and those from Wyoming are in the Museum of Natural History of the University of Kansas.

Colorado. *Routt Co.*: Hahns Peak, 2; Hayden, 1. *Jackson Co.*: Pearle, North Park, 9000 ft., 2; Canadian Creek, North Park, 6; 5 mi. E Canadian Creek, 1; Rabbit Ear Mts., Arapaho Pass, 5. *Larimer Co.*: Elkhorn, 7000 ft., 1; Estes Park, 7. *Grand Co.*: Coulter, 4. *Boulder Co.*: Longs Peak, 3; Gold Hill (the skin only; skull does not belong), 1; 3 mi. S Ward, 9000 ft., 10 (K. U.); 5 mi. W Boulder, 7. *Gilpin Co.*: Blackhawk (U. S. N. M.), 2. *Jefferson Co.*: Golden, 1; Golden foothills, 7300 ft., 1. *Park Co.*: Como, South Park, 9800 ft., 1. *El Paso Co.*: Cascade, 1 (too young for certain subspecific identification).

Wyoming. *Carbon County*: 13 mi. E and 6 mi. S Saratoga, 8500 ft., 1; 14 mi. E and 6 mi. S Saratoga, 8800 ft., 1; 7 mi. S and 11 mi. E Saratoga, 5; 8 mi. S and 6 mi. E Saratoga, 10; 10 mi. N and 14 mi. E Encampment, 8000 ft., 2; 10 mi. N and 16 mi. E Encampment, 8000 ft., 1; 8 mi. N and 16 mi. E Encampment, 8400 ft., 10. *Albany Co.*: 2¼ mi. ESE Browns Peak, 10300 ft., 7; 3 mi. ESE Browns Peak 10000 ft., 5; 2 mi. S Browns Peak, 10600 ft., 7; 3 mi. S Browns Peak, 1; 2 mi. E and ½ mi. S Medicine Bow Peak, 10800 ft., 2; 5 mi. N Laramie, 7200 ft., 1; 1 mi. E Laramie, 7164 ft., 18; Laramie Mts., 10 mi. E Laramie (8500 ft., 2; 9000 ft., 1), 3 (U. S. B. S.); 5½ mi. ESE Laramie, 8500 ft., 4; 8 mi. E and 4 mi. S Laramie, 8600 ft., 5; 8 mi. E and 6 mi. S Laramie, 8500 ft., 1; 15 mi. SE Laramie, Pole Mtn., 8200 ft., 3 (U. S. B. S.); 1 mi. SSE Pole Mtn., (8250 ft., 4; 8350 ft., 6), 10; 1 mi. S Pole Mtn., 8350 ft., 2; 2 mi. SW Pole Mtn., 8300 ft., 6; 2½ mi. S Pole Mtn., 8340 ft., 1; 3 mi. S Pole Mtn., 1; Woods P. O., 2 (U. S. N. M.); Fort Russell, 1 (U. S. N. M.); Sherman, 2 (U. S. N. M.).

Additional records.—Bailey (N. Amer. Fauna, 39:101, 112, November 15, 1915) has recorded the following specimens, which on geographic grounds, would presumably be referable to *Thomomys talpoides rostralis*. Colorado: Estes Park (referred by Bailey, p. 101, to *T. t. clusius*), 1; Colorado City, 1; Colorado Springs, 2½ mi. N, 6000 ft., 1; Colorado Springs, east of Palmer Park, 1; Montgomery, 3; Nederland, 4; Teller County Divide, 1. These specimens have not been examined by us.

Thomomys talpoides attenuatus new subspecies

Type.—Male, adult, skull and skin, no. 15095 Mus. Nat. Hist., Univ. Kansas; from 3½ mi. W Horse Creek Post Office, 7000 ft., Laramie County, Wyoming; obtained on July 16, 1945, by Henry W. Setzer; original no. 629.

Range.—Southeastern Wyoming from Niobrara County south into Weld County, Colorado.

Diagnosis.—Size small; color pale (whitish); skull smooth and, relative to its length, slender; rostrum relatively long; nasals truncate posteriorly; middle parts of zygomatic arches straight; temporal ridges low and more widely separated in middle extent than at anterior or posterior ends; tympanic bullae rounded and moderately inflated; interpterygoid space V-shaped.

Comparisons.—From *Thomomys talpoides bullatus* (topotypes) to the northward, *T. t. attenuatus* differs in smaller size, lighter (less brownish, more whitish) color, smaller and slenderer skull. In detail, some cranial features diagnostic of *attenuatus,* when compared with *bullatus,* are: Anterolateral angle of zygoma less nearly a right angle; temporal ridges bowed outward at middle, instead of straight, and farther apart posteriorly than anteriorly instead of nearly parallel; sides of basioccipital nearly straight instead of concave.

From *Thomomys talpoides cheyennensis* (holotype and Wyoming specimens from: Pine Bluff; 1 mi. W Pine Bluffs, 5000 ft.; 12 mi. N and ½ mi. W Pine Bluffs) to the eastward, *T. t. attenuatus* differs in smaller size throughout and more slender skull. The two subspecies are indistinguishable in color.

From *Thomomys talpoides macrotis* (topotypes) to the southward, *T. t. attenuatus* differs in smaller size, slightly lighter (less brownish and more whitish) color, smaller and slenderer skull.

From *Thomomys talpoides rostralis* (specimens from the type locality) to the westward, *T. t. attenuatus* differs in smaller size; lighter (grayer, less brownish) color, smaller and less angular skull.

From *Thomomys talpoides clusius* (topotypes) to the northwestward, *T. t. attenuatus* differs in shorter body, slightly grayer color, less width across mastoid region of skull, smaller tympanic bullae, and more obtuse anterolateral angle on zygoma.

Remarks.—This subspecies is of smaller size than any of the geographically adjoining subspecies. Intergradation with *T. t. cheyennensis* is shown by specimens from two miles south and nine and one-half miles east of Cheyenne, Wyoming. Intergradation with *T. t. bullatus* or *T. t. clusius* or both is suggested by the larger size of the specimen from five miles southwest of Wheatland, Wyoming. Although large, this skull has the slender proportions of *attenuatus* to which the specimen is tentatively referred. Although the specimens from Avalo, Colorado, are typical *attenuatus,* the specimen from Pawnee Buttes, Colorado, is somewhat larger than typical *attenuatus* and suggests intergradation with the subspecies to the southward, for example, at Flagler, Colorado.

Specimens examined.—Total number, 44, and unless otherwise indicated in the Museum of Natural History of the University of Kansas.

Wyoming. *Niobrara County*: 10 mi. N Hatcreek Post Office, 5300 ft., 1. *Platte Co.*: 5 mi. SW Wheatland, 1 (U. S. B. S.). *Goshen Co.*: Little Bear Creek, 20 mi. SE Chugwater, 1 (U. S. B. S.). *Laramie Co.*: 5 mi. W and 1 mi. N Horse Creek P. O., 7200 ft., 1; 3½ mi. W Horse Creek P. O., 7000 ft., 6; 2½ mi. W Horse Creek P. O., 6600 ft., 1; 2 mi. W Horse Creek P. O.,6600 ft., 2; Horse Creek 6500 ft., 1; 3 mi. E Horse Creek P. O., 6400 ft., 5; 6 mi. W Islay, 2 (U. S. B. S.); 2 mi. S and ½ mi. E Pine Bluffs, 5200 ft., 1; 7 mi. W

Cheyenne, 6500 ft., 1; Cheyenne, 7 (U. S. N. M.); 1 mi. S and 4½ mi. E Cheyenne, 5200 ft., 1; 2 mi. S and 9½ mi. E Cheyenne, 5200 ft., 3; Arcola, 5200 ft., 4.

Colorado. *Weld Co.*: Pawnee Buttes, 5300 ft., 1 (U. S. B. S.). *Logan Co.*: Chimney Canyon, 10 mi. NE Avalo, 5100 ft., 5 (U. S. B. S.).

Museum of Natural History, University of Kansas, Lawrence. Transmitted January 15, 1951.

Table 1. Measurements, in Millimeters, of Two Subspecies of Thomomys talpoides.

Catalogue number or number of individuals averaged	Sex	Total length	Length of tail	Length of hind foot	Basilar length	Zygomatic breadth	Least interorbital constriction	Mastoidal breadth	Length of nasals	Breadth of rostrum	Length of rostrum	Alveolar length of maxillary tooth-row
					T. t. rostralis, from type locality							
17092	♂	220	56	28	33.2	23.7	6.4	19.5	15.5	8.1	17.5	8.2
17095	♂	228	68	30	33.3	....	6.5	18.8	15.0	7.4	17.3	7.3
17091	♂	212	56	27	33.0	22.8	6.5	18.7	14.2	8.5	16.2	7.6
Average	♂	220	60	28.3	33.2	23.2	6.5	19.0	14.9	8.0	17.0	7.7
9 av.	♀	214	56	27.1	31.6	22.4	6.5	18.5	14.4	7.8	16.8	7.9
min.	♀	198	45	25	30.0	20.7	6.2	17.7	13.2	7.4	15.4	7.1
max.	♀	230	72	28.5	33.5	23.3	7.0	19.8	14.9	8.1	17.7	8.4
					T. t. attenuatus, from type locality							
15095	♂	202	61	26	30.1	21.2	6.6	18.2	13.6	7.3	16.0	7.0
15094	♂	189	56	24	29.7	20.1	5.7	17.2	12.4	7.2	14.8	6.9
					from 2½ mi. W Horse Creek P. O., 6600 ft.							
15100	♂	196	58	27	30.2	21.7	6.1	18.4	14.5	7.5	16.3	7.0
3 av.	♂	196	58	25.7	30.0	21.0	6.1	17.9	13.5	7.3	15.7	7.0
					from type locality							
15096	♀	203	59	26	30.0	....	6.1	18.0	14.1	7.3	16.3	6.8
15098	♀	192	69	26	28.8	19.8	5.5	17.2	12.0	6.7	14.7	7.3
					Horse Creek, 6500 ft.							
15103	♀	181	58	25	29.6	19.5	5.9	16.3	13.0	6.9	15.2	7.0
					3 mi. E Horse Creek P. O., 6400 ft.							
15107	♀	190	54	27	30.5	20.5	6.0	17.9	13.5	7.3	16.4	6.8
15106	♀	192	55	26	30.8	21.5	6.5	18.2	12.7	7.6	15.5	7.0
5 av.	♀	192	59	26	29.9	20.3	6.0	17.5	13.1	7.2	15.6	7.0

23-6627

Mammals Obtained by Dr. Curt von Wedel from the Barrier Beach of Tamaulipas, Mexico

BY

E. RAYMOND HALL

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Mammals Obtained by Dr. Curt von Wedel from the Barrier Beach of Tamaulipas, Mexico

BY

E. RAYMOND HALL

WHAT species of mammals occur on the "coastal island", barrier beach, of Tamaulipas? Are the closest relatives of these mammals on Padre and Mustang islands of Texas, instead of on the mainland of Tamaulipas, or are the mammals on the barrier beach distinct from all others? These were questions that Dr. von Wedel of Oklahoma City and I asked ourselves in March of 1950 when we were in southern Texas. With the aim in mind of answering these questions, Dr. von Wedel arranged round-trip transportation, by air, for the two of us between Brownsville, Texas, and Boca Jesús María. The latter place is a "pass", tidal inlet, through the long barrier beach. The waters of the Gulf of Mexico and of the lagoon behind the beach flow back and forth with the changing tides through the inlet.

We arrived at Boca Jesús María on March 18, 1950, and left on March 22, 1950. Our headquarters there were in one of the four one-story buildings immediately north of the inlet. This place is approximately 89½ miles south, and 10 miles west, of Matamoros, Mexico. Most of our collecting was done on the sand dunes one and one-half miles north of the buildings but on the evening of March 20 we made a round-trip, by boat of course, to the sand dunes on the south side of the inlet to set traps; these traps, and the *Dipodomys* that were caught in them, were picked up the following morning.

At the time of our visit, the part of the barrier beach south of the tidal inlet was connected with the mainland. The connection was far to the southward, according to our pilot, Mr. Kagy of Brownsville, and also according to the testimony of the Mexicans at the fishing camp where we stayed on the north side of the inlet. The barrier beach which lay to the north of the inlet extended sixty-odd miles northward to the delta of the Río Grande and had, we were told, eight "passes," including Paso Jesús María. At the time of our visit, however, only three of these tidal inlets were open, it was said; the five others were thought to be filled in with sand, which

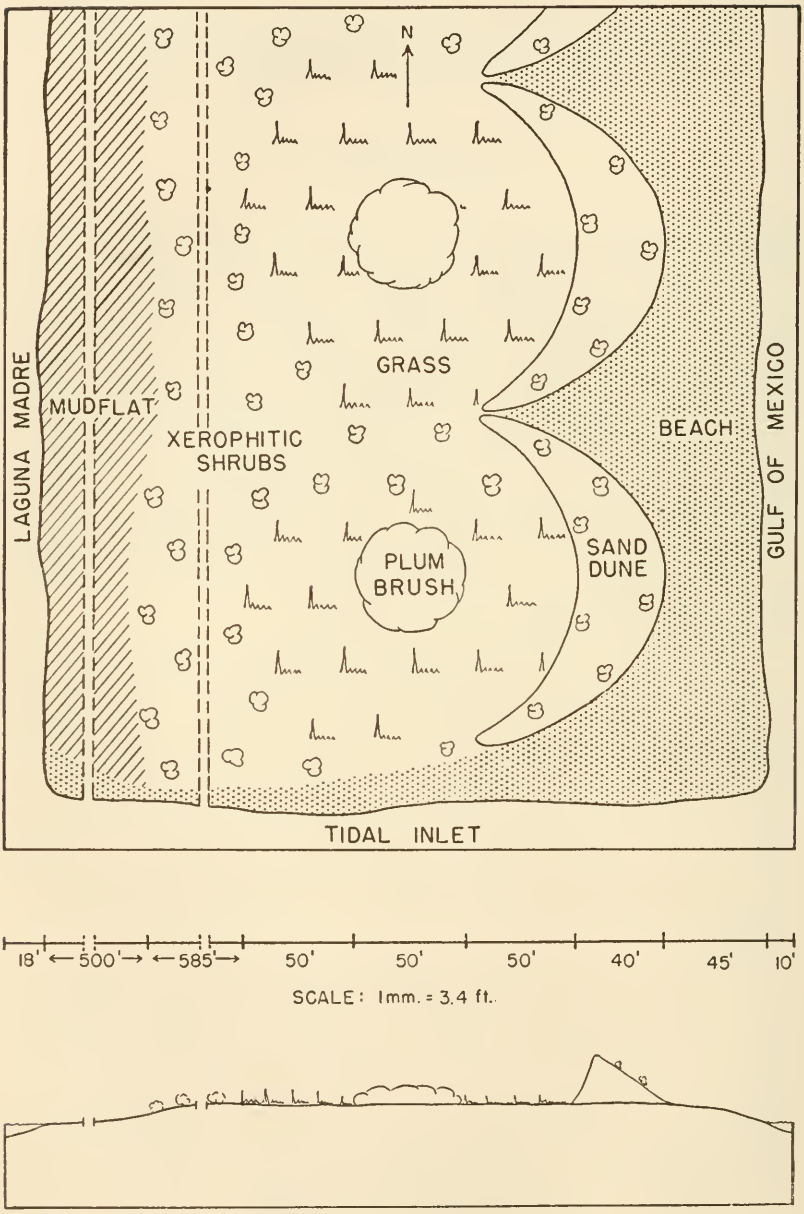

FIG. 1. Diagram of physiographic features of the barrier beach of Tamaulipas. Top view looking down, as from an airplane, on the beach. Bottom view is profile.

permitted terrestrial animals to move from one part of the beach to another. Dr. von Wedel and I saw two tidal inlets that were open when we were being flown back to Brownsville.

The long, low, sandy island, technically a barrier beach, irrespective of tide varied in width from a quarter of a mile to as much as a mile and was separated from the mainland by the Laguna Madre, which was four miles wide opposite our trapping station. To the northward the width of the lagoon gradually increased until, at a place thirty miles north of our trapping station, the lagoon was almost 20 miles wide.

The island was perhaps four feet above high tide. Superimposed on this, in places, there were sand dunes, technically barchans, so arranged that the end of one touched the end of the next. The tops of some were as much as 20 feet above high tides and the chain of these connected-dunes on which we trapped was approximately a mile long. Incipient tidal inlets were frequent; they were where storm-driven waves of high tides had broken across the island between the adjacent ends of two dunes. The windward side of a dune was toward the Gulf and the slope of that side was gentler than that on the leeward side. According to the cycle described by Davis (Proc. Amer. Acad. Arts and Sciences, 22:303-332, 1896) and recently figured on page 364 by Lobeck (Geomorphology, 1st ed., xii + 731 pp., 1939, McGraw Hill Book Co., Inc., New York) the barrier beach concerned was in the early part of the "Middle Youth Stage".

Typically, on the center of the area in the lee of a dune there was a patch of plum brush, almost five feet tall and so dense that a person could not penetrate it. A belt of grass, 20 to 100 feet wide, surrounded the plum brush. The grass was approximately 20 inches high. Outside the area of grass, there were widely-spaced xerophitic shrubs which grew also on the dunes. The diagram (fig. 1) shows these prominent features as a person might see them if he looked directly down from an airplane.

We obtained specimens of the spotted ground squirrel (*Citellus spilosoma*), Ord kangaroo rat (*Dipodomys ordii*), hispid cotton rat (*Sigmodon hispidus*) and black-tailed jack rabbit (*Lepus californicus*). Tracks and other sign of the coyote (*Canis latrans*) were seen. So far as we could ascertain, by our own investigations and from our Mexican hosts at the fishing camp, no other kinds of native mammals lived on the island. The ground squirrel and kangaroo rat were found by us on only the sandy areas where there were

xerophitic shrubs. The cotton rat was found only in the grass. The jack rabbit and coyote ranged over the whole of the island excepting the areas of plum brush in which we saw no sign of any mammal.

To answer the second of our initial questions: The affinities of the mammals of the barrier beach of Tamaulipas are approximately equally divided between those of the mainland and those of Padre Island. The ground squirrel is indistinguishable from the subspecies which occurs both on the mainland and Padre Island to the northward; the other three kinds of mammals of which we obtained specimens prove to be subspecifically distinct from any previously named kinds and seem to be confined to the off-shore beach. Accounts of these four mammals and of a previously unnamed subspecies of kangaroo rat on Mustang Island, Texas, follow.

Citellus spilosoma annectens (Merriam)

Spotted Ground Squirrel

1893. *Spermophilus spilosoma annectens* Merriam, Proc. Biol. Soc. Washington, 8:132, December 28, type from "The Tanks," 12 mi. from Point Isabel, Padre Island, Texas.

1904. [*Citellus spilosoma*] *annectens*, Trouessart, Catalogus Mammalium . . ., p. 340.

Thirteen specimens (Nos. 35441-35453) were collected. All are from the north side of the tidal inlet. Although the ground squirrels were easily trapped, it was difficult to obtain a perfect skin because the gulls (*Larus* sp.) pulled the skin off of the distal part of the tail as soon as a squirrel was secured in a trap. The specimens seem not to differ from Texan specimens from the type locality and Mustang Island.

Dipodomys ordii parvabullatus new subspecies

Ord Kangaroo Rat

Type.—Male, adult, skull and skin, No. 35454, Mus. Nat. Hist. Univ. Kansas, from island, 88 miles south and 10 miles west of Matamoros, Tamaulipas, Mexico; obtained 19 March 1950 by E. R. Hall and Curt von Wedel; original No. 6778 E. R. Hall.

Range.—Islands along coast of Tamaulipas, Mexico.

Diagnosis.—Size small (see measurements). Color pale; entire dorsal surface Light Ochraceous-Buff (Capitalized color terms according to Ridgway: Color Standards and Color Nomenclature, Washington, D. C., 1912), purest on sides and flanks, upper parts lightly suffused with black; cheeks white; plantar surfaces of hind feet, dorsal and ventral stripe of tail, and anterior face of ear brownish. Skull small; auditory bullae smaller (actually and relative to remainder of skull) than in any other known kind of *Dipodomys*, excepting the one from Mustang Island, Texas (named beyond) in which the breadth is approximately the same; rostrum and interorbital region narrow.

Comparisons.—From *Dipodomys ordii sennetti* (Allen), of the mainland of Texas, *D. o. parvabullatus* differs in: Color paler on pigmented areas; white areas more extensive; skull smaller, in all parts measured, except the nasals which are slightly longer. From *Dipodomys ordii compactus* of Padre Island, Texas, *D. o. parvabullatus* differs in: Tail and hind foot shorter; skull smaller in all parts measured, especially so in breadth across maxillary processes of zygomatic arches.

Remarks.—*D. o. parvabullatus* resembles *D. o. sennetti* in external proportions and *D. o. compactus* in cranial proportions.

No difference was detected between specimens from the two sides of the tidal inlet 89 miles south of Matamoros. Only one of the 14 specimens is of the light color phase (upper parts Cartridge Buff). This pale specimen is from the north side of the inlet. The brownish stripe on the ventral side of the tail is absent on the distal two-fifths of the tail and the specimens are uniform in this respect. On the occlusal surfaces of the cheek-teeth, the enamel surrounding the dentine is incomplete on both the lingual and labial sides of the teeth of five individuals and is incomplete on the labial side of some of the teeth of a sixth specimen.

In the snap traps, all of which were baited with rolled oats, more than twice as many land crabs as kangaroo rats were taken. Judging from tracks in the sand, land crabs greatly outnumbered kangaroo rats. The parietal bones in two of the 13 skulls are much eroded by some parasite (seemingly nematode worms) and in one of these two specimens the roof of the left tympanic cavity is perforated. As regards life-zones, the occurrence of *Dipodomys ordii* in the lower part of the Lower Sonoran Life-zone on the off-shore beach 88 and 90 miles south of Matamoros is low zonally and perhaps is at or near the zonal margin of the range of the species. The crabs and worms conceivably are two of the environmental features inhospitable to the rats.

Specimens examined.—Total, 14, all from Tamaulipas, Mexico, as follows: 88 mi. S and 10 mi. W Matamoros, 7; 90 mi. S and 10 mi. W Matamoros, 7.

When Setzer (Univ. Kansas Publ., Mus. Nat. Hist., 1:473-573, December 27, 1949) reviewed the subspecies of *Dipodomys ordii* he lacked specimens of *Dipodomys ordii compactus* from the type locality or from anywhere else on Padre Island. He used as representative of *D. o. compactus* specimens from Mustang Island, Texas, the island next northeast of Padre Island. Through the courtesy of Mr. Stanley P. Young, Dr. Hartley H. T. Jackson and Miss Viola S.

Schantz, of the United States Biological Surveys Collection, I have examined topotypes of *D. o. compactus* from Padre Island. This examination discloses that the kangaroo rats on Padre Island and Mustang Island are significantly different. Those from Mustang Island may be named and described as follows:

Measurements (in millimeters) of adult males of four subspecies of Dipodomys ordii

	Total length	Length of tail	Length of hind foot	Greatest length of skull	Greatest breadth across bullae	Breadth across maxillary arches	Width of rostrum	Length of nasals	Least interorbital width	Basilar length
D. o. largus, type locality (K. U.)										
Mean (9)....	226	117	35.8	36.3	21.5	19.2	3.6	13.7	12.6	23.2
Maximum....	241	128	37	37.2	22.0	19.9	3.7	14.2	13.9	23.9
Minimum....	212	105	35	35.2	20.7	18.6	3.5	13.5	11.6	22.3
D. o. compactus, type locality (U. S. N. M.)										
Mean (10)....	230	126	37.7	36.6	22.1	20.0	3.8	14.0	12.5	23.8
Maximum....	241	135	40	37.8	23.2	21.4	4.0	14.5	13.1	24.4
Minimum....	208	118	35	35.5	21.6	19.2	3.6	13.1	11.3	23.1
D. o. parvabullatus, type locality and 2 mi. S of same (K. U.)										
Mean (7)....	216	111	35.9	36.4	21.7	19.6	3.6	13.8	12.1	23.0
Maximum....	222	113	37	36.9	22.1	20.7	3.8	14.2	12.5	23.5
Minimum....	210	109	34	35.9	21.3	19.1	3.3	13.4	11.6	22.1
D. o. sennetti, 2 mi. S Riviera, Texas (after Setzer, op. cit. :565)										
Mean (5)....	218	112	35.8	37.2	23.4	20.1	4.0	13.6	13.1	24.2
Maximum....	222	115	38	38.2	24.1	20.7	4.3	14.4	13.2	24.6
Minimum....	208	104	34	36.3	23.0	19.4	3.8	13.0	12.6	23.8

Dipodomys ordii largus new subspecies

Ord Kangaroo Rat

Type.—Female, adult, skull and skin, No. 27234, Mus. Nat. Hist., Univ. Kansas, from Mustang Island, 14 mi. SW Port Aransas, Aransas County, Texas; obtained 30 June 1948 by W. K. Clark; original No. 543.

Range.—Known from Mustang Island only.

Diagnosis.—Size medium (see measurements). Color pale, and as described for *D. o. parvabullatus.* Skull small; auditory bullae (actually and relative to remainder of skull) smaller than in any other known kind of *Dipodomys,* except *D. o. parvabullatus* in which breadth across bullae is approximately the same; notably narrow across maxillary processes of zygomatic arches.

Comparisons.—From *Dipodomys ordii sennetti* (J. A. Allen) of the mainland, *D. o. largus* differs in: Color paler on pigmented areas; white areas more extensive; skull averaging smaller except in basilar length and length of nasals which are approximately the same as in *D. o. sennetti.* From *Dipodomys ordii compactus* True of Padre Island, *D. o. largus* differs in: Body longer; tail shorter; skull narrower across tympanic bullae and across maxillary processes of zygomatic arches; nasals shorter. From *Dipodomys ordii parvabullatus* of the coastal island south of Padre Island, along the gulf coast of Tamaulipas, *D. o. largus* differs in: Body and tail longer; basilar length of skull averaging less; breadth across maxillary processes of zygomatic arches greater; premaxillae not extending so far behind nasals.

Remarks.—*D. o. largus* resembles *D. o. compactus* in external proportions and *D. o. parvabullatus* in cranial proportions. The degree of difference between *D. o. compactus* and *D. o. largus* is less than between *D. o. compactus* and *D. o. parvabullatus.* To me, the three subspecies mentioned in the preceding sentence are indistinguishable in color.

Two of the eleven specimens of *D. o. largus* are of the light color phase (upper parts Cartridge Buff) whereas all but two of the eleven specimens of *D. o. compactus* are of the light color phase. Each of the cheek-teeth of the upper jaw of *D. o. largus* has a complete ring of enamel around the dentine of the occlusal surface, as described by Setzer (Univ. Kansas Publ., Mus. Nat. Hist., 1:517, December 27, 1949) for *D. o. compactus.* The upper dentitions of ten specimens of *D. o. compactus* examined by me in this respect reveal a total of only five teeth (in four individual animals) that have the enamel ring incomplete; one premolar and three molars are incomplete on the lingual side and one molar is incomplete on the labial side.

Two specimens from Bagdad, Tamaulipas, in the delta of the Río Grande (Nos. 116485 and 11487, U. S. N. M., Biol. Surv. Coll.), are referred to *D. o. compactus* on basis of long body and long tail. The specimens, both Light Ochraceous-Buff, are so young that not all of the enamel is worn off the crowns of the cheek-teeth. Specimens of *D. o. compactus, D. o. parvabullatus* and *D. o sennetti* of comparable age are not available, and it, therefore, is impossible to know whether size and shape of the skull in the population at Bagdad are the same as they are in *D. o. compactus* of Padre Island.

Specimens examined.—Total, 11, all from Texas. Aransas County: Mustang Island, 14 mi. SW Port Aransas.

Sigmodon hispidus solus new subspecies

Hispid Cotton Rat

Type.—Male, adult, skull and skin; No. 35468, Mus. Nat. Hist., Univ. Kansas; from island, 88 mi. S and 10 mi. W Matamoros, Tamaulipas, Mexico; 22 March 1950; obtained by E. R. Hall and Curt von Wedel; original No. 6806 E. R. Hall.

Range.—Known from the type locality only but probably occurring on most of the chain of islands off the coast of Tamaulipas.

Diagnosis.—Small; hind foot short; rostrum broad.

Comparison.—From its nearest relative, geographically and morphologically, *Sigmodon hispidus berlandieri* Baird of the adjacent mainland, *S. h. solus* differs in smaller size, and a rostrum that is broader in relation to the length of the skull.

Remarks.—On the last night of our stay on the island, traps set in grass approximately 20 inches high, yielded one pair of *Sigmodon.* The color is lighter than in the average of specimens from the mainland (for instance those from Victoria and Soto la Marina) but can be matched by selected specimens. In animals of equal age, the hind foot and basilar length are shorter in *S. h. solus* than in *berlandieri.* The broadening of the rostrum, which occurs with advanced age, is attained in *solus* when the skull is yet short; the maximum breadth of the rostrum in the adults is more, instead of less, than a fourth of the basilar length.

Measurements.—The following measurements are of specimens in which the occlusal face of each molar tooth is worn flat. The first measurement is of the holotype followed by the corresponding measurement of a male of *T. b. berlandieri,* No. 116466 from Camargo, Tamaulipas, in parentheses. The third measurement is that of the female from the type locality of *S. h. solus* and it is followed by the corresponding measurement of a female of *T. b. berlandieri,* No. 116462 from Camargo, Tamaulipas. Total length, 266 (298),—(293); length of tail, 113 (135),—(137); length of head and body, 153 (163), 155 (156); length of hind foot, 30 (35), 30 (33); basilar length of Hensel, 28.2 (28.9); 27.9 (29.0); zygomatic breadth, 19.5 (—), 19.0 (20.8); mastoidal breadth, 13.9 (14.4), 13.9 (14.8); greatest breadth of rostrum, 7.2 (7.3), 7.8 (7.2); length of nasals, 14.6 (14.1), 13.4 (14.2); crown length of upper molar teeth, 6.3 (6.1), 6.3 (5.9).

Specimens examined.—Two from the type locality.

Lepus californicus curti new subspecies

Black-tailed Jack Rabbit

Type.—Female, adult, skull and skin, No. 35470, Mus. Nat. Hist., Univ. Kansas; from island, 88 miles south and 10 miles west of Matamoros, Tamaulipas, Mexico; obtained 19 March 1950 by E. R. Hall; original No. 6783.

Range.—Islands along coast of Tamaulipas, Mexico.

Diagnosis.—Color pale; size small; ears short; tympanic bullae small.

Comparisons.—From *Lepus californicus merriami* Mearns (specimens from Fort Clark, Brownsville and intermediate localities), *L. c. curti* differs in paler color, lesser size except ear that is of almost same length and except interorbital breadth that is approximately same in the two subspecies; tympanic bullae notably smaller. From *Lepus californicus altamirae* Nelson, *L. c. curti* differs in having the black patch on the nape less definitely divided by a median, longitudinal band of buffy color, and lesser size. Exception is to be made for the ear and tympanic bullae, which are of approximately the same size in the two subspecies.

Remarks.—The subspecific part of the name *Lepus californicus curti* is proposed in honor of Dr. Curt von Wedel who shared the pleasure of collecting on the islands where this handsome hare lives.

The specimens of *L. c. curti* are all females, which, in the genus *Lepus,* average larger than the males. Comparison of the measurements recorded below with those in the account by Nelson (N. Amer. Fauna, 29:129, 1909) may not reveal the full measure of difference in size between *L. c. curti* and other subspecies because Nelson (*op. cit.*) pooled males and females in obtaining the average measurements that he records. For example, he used three males and two females of *Lepus altamirae* in obtaining an average (*op. cit.*:117). The specimens of *L. c. curti* here recorded are thought to be of full size inasmuch as the degree of fusion of bones in the skull, and the density of the cranial bones indicate full adulthood for each specimen. Reproductive-wise, there is no question as to adulthood; each of the four females was pregnant. One specimen had two embryos (each 30 millimeters long in crown-rump measurement) and each of the other specimens contained one embryo. These three embryos were 55, 60, and 105 mm. long.

Three of our specimens, including the holotype, were obtained north of the eighth pass and the other specimen, No. 35473, was obtained a few hundred yards south of the pass. Because the part of the barrier beach south of the pass was connected to the mainland, it is likely that the newly named subspecies occurs also on the adjacent mainland; however, we have examined no specimens of *Lepus californicus* from the opposite mainland except from Matamoros, ninety miles to the north, and from Altamira, approximately one hundred and fifty miles south of our collecting locality. A specimen from Matamoros, Tamaulipas, and several from Brownsville, Texas, in size of auditory bullae, larger overall size and darker color clearly are *L. c. merriami* and not *L. c. curti.*

The small tympanic bullae of the specimens from Padre Island

were commented upon by Nelson (*op. cit.*:149) who found smallness of bullae to characterize many of the specimens from the eastern part of the geographic range of *L. c. merriami.* In the northeastern part of the geographic range of *L. c. merriami,* as Nelson pointed out, the small size of the tympanic bullae was one of several evidences of intergradation there with *Lepus californicus melanotis,* the subspecies next adjacent to the north. In the light of present information, it seems that the smallness of the tympanic bullae in the specimens (3) from Padre Island may be an independent development—an adaptation to environmental conditions that reaches its fullest development on the same chain of islands eighty-odd miles southward of Matamoros. The specimens from Padre Island, although possessing small bullae, in other features, for example, larger size of other parts, are *merriami.*

The four specimens of *L. c. curti* are in worn winter pelage and the new pelage is coming in on the thighs. Most of the specimens (6) of the *L. c. altamirae* are in the same condition of pelage. In color and color pattern, the two subspecies are, to me, indistinguishable except that the black patch on the nape is less widely and less definitely separated into two parts by a median, longitudinal, band of buffy color.

Lepus californicus altamirae was named by Nelson (Proc. Biol. Soc. Washington, 17:109, May 18, 1904) as a black-tailed jack rabbit, *Lepus merriami altamirae,* but was later transferred by Nelson (N. Amer. Fauna, 29:124, 1909) to the white-sided section of the genus and arranged as a full species, *Lepus altamirae.* In making this transfer, Nelson (*op. cit.*:125) wrote that in "This well marked species . . . the lack of a black patch on the posterior half of the ear at the tip and the white flanks (somewhat obscured in some of the original specimens) are strong characters which place it in the *callotis* group." "Posterior half of ears white without any trace of black at tip", was the way Nelson (*op. cit.*:124) described the ears in *L. altamirae.* My examination of the original series including the type, reveals that the ears do have some black at the tip of the posterior half in three of the specimens, some brown in one other specimen, and only a dusky tinge in two others. In the four specimens of *L. c. curti* the tip of the ear is faintly brownish in one animal and dusky in three. The extent of the white flanks seems to be identical in the two series. Fortunately they are in the same pelage and same stage of molt on the hind legs. The one difference that I can detect is in the coloration of the nape. In each of the specimens of *L. altamirae* the coloration is as described by Nelson (*op. cit.*:124):

"nape with two lateral black bands extending back from base of ears, and separated by a median band of buffy." In *L. c. curti* the nape is all black in one specimen and the median band of buffy is present in the other three but is narrower and more dusky than in *L. altamirae.* Since the characters (color of tip of ear and extent of white on the flank) relied upon by Nelson for placing *L. altamirae* in the *callotis* group are duplicated in the *californicus* group, in *L. c. curti,* there is reason for questioning whether *altamirae* is correctly placed, taxonomically, in the *L. callotis* group.

Cursory examination of skulls of the *callotis* group and the *californicus* group indicates that the prepalatal spine (the part of the palate which extends anteriorly toward the vomer) is longer in *L. californicus* than in *L. callotis, L. gaillardi* and *L. alleni.* In this feature, *L. altamirae* agrees with *Lepus californicus* and differs from members of the *Lepus callotis* group. Furthermore, the newly named *L. c. curti,* in color of ear and color of nape, is intermediate between *L. altamirae* and *L. c. merriami.* Consequently, *Lepus merriami altamirae* Nelson, it seems, should stand as *Lepus californicus altamirae.*

Mention should be made here of the view of Shamel (Proc. Biol. Soc. Washington, 55:25-26, May 12, 1942) that the *californicus* group should be divided into two groups (each group possibly amounting to something more than a species and something less than a subgenus) on the basis of a white rump and complex infolding of the enamel layer of the front of the first upper incisor *versus* a dark rump and simple infolding of the mentioned layer of enamel. He placed *Lepus californicus merriami* Mearns, among other subspecies, in a group different from the one in which he placed several other subspecies of *Lepus californicus.*

Specimens (skulls with accompanying skins) of the species *Lepus californicus* in the Biological Surveys Collection of the United States National Museum, representative of a gradual transition from the dark rump and simple fold in the enamel to the white rump and complex fold in the enamel are as follows: *L. c. deserticola,* No. 29733/41808, Paharanagat Valley, Nevada; Nos. 117463 and 156744, Beals Spring, Arizona. *L. c. texianus,* No. 24635/32031, Springerville, Arizona; No. 97453, Roswell, New Mexico; No. 118751, Toyah, Texas; No. 118749, Valentine, Texas; and No. 108700, Terlingua Creek, Texas. In the continuously distributed species *Lepus californicus,* along the northwest to southeast line provided by the localities of occurrence listed immediately above, there is a gradual transition from one kind of fold to the other kind and from one color

of rump to the other color. It is clear that Shamel (*op. cit.*) was in error in his conclusions; the kinds of black-tailed jack rabbits to which Shamel (*op. cit.*) applied the name *Macrotolagus* should stand as given below.

Correct names:
Lepus alleni alleni Mearns
Lepus alleni palitans Bangs
Lepus alleni tiburonensis Townsend
Lepus gaillardi gaillardi Mearns
Lepus gaillardi battyi J. A. Allen
Lepus callotis Wagler
Lepus flavigularis Wagner
Lepus californicus altamirae Nelson
Lepus californicus melanotis Mearns
Lepus californicus merriami Mearns
Lepus californicus asellus Miller
Lepus californicus festinus Nelson
Lepus californicus texianus Waterhouse

Measurements (in millimeters) of adults of two subspecies of Lepus californicus

	Total length	Tail-vertebrae	Hind foot	Ear from notch in dried skin[1]	Basilar length	Length of nasals	Breadth of rostrum above premolars	Depth of rostrum in front of premolars	Interorbital breadth	Parietal breadth	Diameter of bulla
L. c. curti, type locality (K. U.)											
♀ 35470	565	55	125	115	72.0	37.1	25.9	21.2	27.4	29.8	13.5
♀ 35471	566	57	122	122	72.8	39.0	25.5	22.0	26.2	29.2	13.9
♀ 35472	520	50	115	105	69.5	38.6	26.0	19.0	24.4	30.2	13.5
♀ 35473	587	53	124	118	72.0	40.9	26.7	22.2	27.4	29.0	13.0
Average	560	54	122	115	71.6	38.9	26.0	21.1	26.4	29.6	13.5
L. c. altamirae, type locality (U. S. N. M., Biol. Surv. Coll.)											
♂ 93691	605	96	137	112	76.5	44.5	26.6	24.6	....	32.0	13.0
♀ 93692	595	71	137	114	77.1	42.5	26.3	23.1	27.0	29.5	13.4
♂ 93693	590	93	137	110	77.8	43.8	27.6	22.5	27.2	30.7	14.2
♀ 93694	605	70	142	118	78.0	45.9	26.8	23.4	28.7	32.0	14.3
♂ 92982	556	59	136	114	75.9	46.5	26.1	22.3	25.8	....	14.0
Average	590	78	138	114	77.1	44.6	26.7	23.2	27.2	31.1	13.8

1. In each specimen of *L. c. curti* the length of the ear measured from the notch when the animal was in the flesh was eight millimeters more than in the dried skin.

The cranial measurements given above are taken, in so far as possible, in the same way that the measurements recorded by Nelson in his North American Fauna (No. 29, 1909) were taken. In that publication he records mostly average measurements but he records also some measurements of individual specimens. Two of these specimens are the holotypes of *Sylvilagus mansuetus* Nelson and *Romerolagus nelsoni* Merriam. By attempting to duplicate Nelson's measurements on these specimens, the following opinions were formed.

"Basilar length" is basilar length of Hensel and the anterior point probably was the posterior border of the alveolus of incisor two. There is some evidence of lack of consistency with respect to the anterior control point.

"Length of nasals" is the over-all length, of the two nasal bones, but in *Romerolagus* the shorter (right) nasal alone seems to have been measured.

"Breadth of rostrum above premolars" is easily duplicated in *Lepus* but in *Sylvilagus* the control points are difficult to find. Two other persons and I obtained three different measurements, all different from Nelson's measurements, and we thought that Nelson would have obtained different measurements by measuring the same specimen of *Sylvilagus* at different times.

"Depth of rostrum in front of premolars" seems to have been taken perpendicular to the inferior longitudinal line of the rostrum, approximately one-half millimeter anterior to the alveolus of the anteriormost cheek tooth.

"Interorbital breadth" was taken across the supraorbital processes, at the narrowest place, but *not* from the notches medial to the antorbital projections of the supraorbital processes.

"Parietal breadth" is the breadth, across the braincase, taken approximately half way between the squamosal root of the zygoma and the external auditory meatus, where there is a lateral bulge in the squamosal bone. On each side of the skull, the calipers rest on the squamosal bone, not on the parietal bone.

"Diameter of bullae" excludes the paroccipital process and was taken from the anteriormost part of a tympanic bulla, posterolaterally to the part of that same bulla, that is exposed at the lateral side of the base of the paroccipital process.

Specimens examined.—Total, four, all from Tamaulipas, Mexico, as follows: 88 mi. S and 10 mi. W Matamoros, 3; 90 mi. S and 10 mi. W Matamoros, 1.

Transmitted February 20, 1951.

□

23-7414

Comments on the Taxonomy and Geographic Distribution of Some North American Rabbits

BY

E. RAYMOND HALL and KEITH R. KELSON

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Comments on the Taxonomy and Geographic Distribution of Some North American Rabbits

BY

E. RAYMOND HALL AND KEITH R. KELSON

IN preparing maps showing the geographic distribution of North American lagomorphs, some conflicting statements in the literature have led us to examine the pertinent specimens of the Florida cottontail and the Audubon cottontail with results as given below. The study here reported upon was aided by a contract between the Office of Naval Research, Department of the Navy, and the University of Kansas (NR 161-791). Unless otherwise indicated, catalogue numbers are of the United States National Museum and most of the specimens are in the Biological Surveys collection of the Fish and Wildlife Service. Grateful acknowledgment is made to persons in charge of the collections for permission to use the collections under their charge.

Sylvilagus floridanus similis Nelson

1907. *Sylvilagus floridanus similis* Nelson, Proc. Biol. Soc. Washington, 20:82, July 22.

Some confusion has existed concerning the subspecific identity of the Florida cottontail in Nebraska because of the way in which Nelson recorded specimens in his "The Rabbits of North America" (N. Amer. Fauna, 29:fig. 11, and pp. 169-174, August 31, 1909). He (*op. cit.*:174) listed the following specimens under the western subspecies, *S. f. similis:* Two topotypes (Nos. 87784 and 18738/25532) and of course the type; the specimen (No. 116288) from the Snake River [= Snake Creek of maps], 11 mi. NW Kennedy; two from Neligh (126074 and 151438); and one (probably 18680/25410) from Kennedy. But, he listed (*op. cit.*:172) under *S. f. mearnsi,* the eastern subspecies, a specimen (10721) from Brownlee, and two from Kennedy. One of the two from Kennedy probably was the one that is recorded in the files of the U. S. Fish and Wildlife Service as "identified by Cary. spec. in Univ. Nebraska". The other, or third, specimen from Kennedy, we judge, did not exist at all but was recorded by Nelson because a card in the reference file, under

Kennedy, Nebraska, in addition to No. 18680/25410, carried a second entry, a number 3471X. The latter is the X-catalogue number of specimen No. 116288 from the Snake River! The X-catalogue is used in place of a field catalogue for specimens sent to the mammal collection of the United States Fish and Wildlife Service, by persons who do not keep regular field numbers of their own. It seems that Nelson prepared (or had prepared) his lists of specimens, at least in part, from cards rather than from the labels on the specimens themselves. Some further confusion as to names that Nelson intended to apply to cottontails in Nebraska resulted from the fact that his map (*op. cit.*:fig. 11) indicated that the localities mentioned above for *S. f. mearnsi* were within the geographic range of *S. f. similis*.

Our comparison of each of the Nebraskan specimens with specimens of *S. f. mearnsi* in comparable pelage from Iowa and with the type and topotypes of *S. f. similis* reveals that each of the specimens of which catalogue numbers are given above is clearly referable to *Sylvilagus floridanus similis*.

Because some mammalogists have suspected that intergradation between *Sylvilagus floridanus similis* and *Sylvilagus nuttallii grangeri* occurs along the eastern base of the Rocky Mountains, we have examined specimens which may throw light on this matter.

From *S. f. similis* (holotype and three topotypes), *S. n. grangeri* (eight practical topotypes from Redfern, South Dakota) differ as follows: Throat patch darker; hind foot shorter; ear (dry) from notch longer; rostrum narrower; posterior extension of supraorbital process enclosing a longer and wider space between it and the braincase; superior border of premaxilla straight in profile instead of convex dorsally; tympanic bullae more inflated; external auditory meatus larger (diameter of the meatus more, instead of less, than crown length of upper molars); posterior border of palate without, instead of with, spine.

Specimens of the two species from places as near each other as extreme southeastern Montana (*S. f. similis* from Boxelder Creek, Capitol and the Little Missouri River) and Devils Tower, Wyoming (*S. n. grangeri*), seem not to differ in the length of the hind foot and the ear and in the color of the spot on the chest. Also, the presence or absence of the spine on the posterior margin of the palate is subject to individual variation in these specimens but the other cranial differences, mentioned above, still are apparent. These same cranial differences are readily apparent between specimens

of the two species taken only five miles apart in eastern Wyoming (for the precise localities, see the following paragraph). It is concluded, therefore, that *S. f. similis* and *S. n. grangeri* do not intergrade along the eastern base of the Rocky Mountains.

Data on specimens from Laramie County in eastern Wyoming show that *S. f. similis* is a heavier animal than *S. n. grangeri* and also that *similis* molts earlier. For example, an adult female (K. U. No. 15936) taken on July 13, 1945, three miles east of Horse Creek P. O., 6400 ft., weighed 1374 grams and is in fresh pelage, whereas an adult female of *S. n. grangeri* (K. U. No. 15935), taken on July 17, 1945, two miles west of Horse Creek P. O., 6600 ft., weighed only 1149 grams, and still has some of the worn winter pelage on the upper parts.

Sylvilagus floridanus holzneri (Mearns)

1896. *Lepus sylvaticus holzneri* Mearns, Proc. U. S. Nat. Mus., 18:554, June 24.
1904. *Sylvilagus floridanus holzneri,* Lyon, Smithsonian Miscl. Coll., 45: 336, June 15.

Examination of cottontail rabbits from Arizona in the Biological Surveys Collection and the United States National Museum indicates that *Sylvilagus auduboni* can be distinguished from *Sylvilagus nuttallii* and *Sylvilagus floridanus* by the larger (more inflated) tympanic bullae. Topotypes of *Sylvilagus nuttallii pinetis* and other specimens from Alpine, Mt. Thomas, Springerville, the Prieto Plateau at 9000 feet on the south end of the Blue Range, and the Tunitcha Mountains are characterized by a posteriorly pointed supraoccipital shield and a long, wide space between the braincase and the posterior extension of the supraorbital process. The cottontails with equally small tympanic bullae from more western and more southern localities are referable to *Sylvilagus floridanus holzneri* on the basis of a posteriorly truncate or emarginate supraoccipital shield and a narrower and shorter space (usually a "foramen") between the braincase and the posterior extension of the supraorbital process. In *S. f. holzneri* the posterior end of the posterior process fuses with the braincase whereas the posterior end of this process in Arizonan specimens of *S. n. pinetis* merely lies against the braincase or projects free of it. In specimens from Arizona the difference in shape of the posterior border of the supraoccipital shield and the difference in size of the space between the braincase and the posterior extension of the supraorbital process are the only differences of taxonomic worth found by us. Many

other features of the skull, of color of pelage, and of size of external parts all fell within the range of individual variation of a series of specimens from one locality.

Specimens from the following localities in Arizona are referable to *Sylvilagus floridanus holzneri* (Mearns).

> Hualpai Mts., Nos. 117461, 117462, 117488, 117490, 117495, 227735, and 227832; Ft. Whipple, No. 214157; Prescott, No. 34667/46752; Mayer, No. 247495; Reynolds Creek Ranger Station, Sierra Ancha Mts., Gila Co., No. 247734; Fish Creek, Tonto National Forest, 2000 ft., No. 212833; north base Mt. Turnbull, 4500 ft., No. 214339; Ash Creek, 6100 ft., Graham Mts., No. 204363; Pinery Canyon, 7500 ft., Chiricahua Mts., No. 247953; Thomas Cañon, 2 mi. E Baboquivari Mts., No. 244420; Pine Springs, 15 mi. south of Colorado Cañon, No. 2425 Amer. Mus. Nat. Hist. On December 4, 1950, we removed the skull of No. 2425 to more certainly ascertain the identity of the individual.

The specimens listed above include those that Nelson (N. Amer. Fauna, 29:211, August 31, 1909) listed from the Hualpai Mountains, Pine Springs, and Prescott under the name *Sylvilagus nuttallii pinetis*. Nelson (*op. cit.*: Pl. X, fig. 2) figured one of these skulls from the Hualpai Mountains as *S. n. pinetis* and the cranial measurements (*op. cit.*:201) that he records for *S. nuttallii pinetis* likewise are of these same specimens of *Sylvilagus floridanus holzneri*. Nelson's description (*op. cit.*:207-210) seems to have been affected by the erroneous (as we see the matter) inclusion of these specimens of *S. f. holzneri* in the materials identified by him as *Sylvilagus nuttallii pinetis*.

The specimens so far mentioned from Arizona can be identified with ease. The identification becomes difficult, however, when the holotype of *S. f. holzneri*, from the Huachuca Mountains, is examined. The difficulty results from the holotype having a barely detectable emargination in the posterior border of the supraoccipital shield. In this respect the holotype is intermediate between *S. f. holzneri* (as known by specimens from more western localities in Arizona) and *S. n. pinetis* from the White Mountains to the northward. As noted above, *S. f. holzneri* has a deep notch and *S. n. pinetis* has none. This intermediacy of the holotype supports the possibility, mentioned by Nelson (*op. cit.*:200), that intergradation occurs between *S. f. holzneri* and *S. n. pinetis*. Additional evidence, however, is against this possibility; the notch in the supraoccipital is deeper in specimens (No. 66136, from Chiricahua Mts., and No. 204364, from Ash Creek in Graham Mts.) from mountains

geographically intermediate between the Huachuca Mountains and the White Mountains. Also, the holotype of *S. f. holzneri* differs from *S. n. pinetis* and agrees with other specimens of *S. f. holzneri* from farther southwest in Arizona in the robustness of the posterior extensions of the supraorbital processes and in the considerable degree of fusion of the tips of these processes with the squamosals. Additionally, the rostrum of the holotype is wide and deep as in other specimens of *S. floridanus* from more eastern localities and is unlike the narrow and shallow rostrum of *S. n. pinetis.*

If intergradation occurs in Arizona between the species *Sylvilagus floridanus* and *Sylvilagus nuttallii,* as Nelson (*op. cit.*:200) intimated it might, the intergrades probably will be found along the Tonto Rim or in the territory between the Blue Range and the Graham Mountains.

Sylvilagus floridanus cognatus Nelson

1907. *Sylvilagus cognatus* Nelson, Proc. Biol. Soc. Washington, 20:82, July 22.

We have examined the specimens recorded by Nelson (N. Amer. Fauna, 29:193, August 31, 1909) and conclude that Nelson (*op. cit.*) accurately described them. We differ from Nelson on one point of interpretation; we prefer to use the trinomial, instead of the binomial, for *cognatus* because the kind and amount of difference between it and subspecies of *Sylvilagus floridanus* (*S. f. holzneri* and possibly *S. f. llanensis*) is on the order of magnitude that distinguishes subspecies, and not full species, of *Sylvilagus.*

The specimen (W. D. Hollister, original No. 208) from the Datil Mountains, lent to us by the Colorado Museum of Natural History, does have, as Nelson (*op. cit.*) pointed out, larger tympanic bullae and a slenderer rostrum than do other specimens of *S. f. cognatus.* Nevertheless, No. 208, agrees with *cognatus* and differs from *Sylvilagus nuttallii pinetis* in the greater vertical depth of the zygoma, the greater transverse width of the first pair of upper incisors, the broader posterior extensions of the supraorbital processes, the fusion (instead of freedom from, or mere touching to, the braincase) of the tips of these extensions, the less upturned supraorbital processes, and the more nearly truncate posterior margin of the supraorbital shield. Therefore, the specimen is referable to *Sylvilagus floridanus cognatus.* The slender rostrum and large tympanic bullae of No. 208 are either individual variations or features peculiar to the population of *Sylvilagus floridanus* in the Datil Mountains.

Sylvilagus floridanus robustus Bailey

1905. *Lepus pinetis robustus* V. Bailey, N. Amer. Fauna, 25:159, October 24.

Nelson (N. Amer. Fauna, 29:194-195, August 31, 1909) described specimens from the Big Bend area of Texas. This was the only area from which Nelson had specimens. Our examination of these same specimens indicates that his description of them was accurate. Davis and Robertson (Jour. Mamm., 25:271, September 8, 1944) recorded a specimen, under the name *Sylvilagus robustus,* from "The Bowl, Guadalupe Mountains, Culberson County, Texas." Our examination of the skull of this specimen (♀ adult, No. 658, Mus. Zool., Louisiana State University) indicates that it is, among named kinds of rabbits, best referred to *robustus.* The specimen is morphologically as well as geographically intermediate between *S. f. cognatus* and *S. robustus.* This morphological intermediacy is illustrated by certain of the following cranial measurements of three adult females: No. 108695 (*robustus*), Chisos Mts.; No. 658 from the Guadalupe Mts.; and No. 128651, NE slope Capitan Mts. Basilar length, 59.2, 54.2, 54.4; length of nasals, 33.9, 31.1, 32.2; breadth of rostrum above premolars, 19.3, 17.5, 17.0; depth of rostrum in front of premolars, 15.8, 14.8, 14.0; interorbital breadth, 20.4, 19.1, 19.7; parietal breadth, 27.2, 27.1, 26.5; diameter of bulla, 13.3, 12.2, 10.7. Considering the intermediate nature of specimen No. 648, and the kind and amount of difference between *Sylvilagus floridanus cognatus* and *S. robustus,* it seems appropriate to us to use the name-combination *Sylvilagus floridanus robustus.*

Actual intergradation, in the sense of interbreeding between individuals of a continuously distributed population of animals, probably does not occur regularly between *S. f. cognatus* and *S. f. robustus* nor between several populations within either one of these subspecies; in south-central Arizona and western Texas the animals are said to occur only in the higher parts of the mountains. Consequently a given population is separated from another by low-lying territory inhospitable to the species *Sylvilagus floridanus.* This low-lying territory is inhabited by another species, *Sylvilagus audubonii.* More intensive collecting in the region concerned may, however, show a continuous distribution of the species *Sylvilagus floridanus* in several areas where it seems now to have an interrupted distribution.

Sylvilagus audubonii neomexicanus Nelson

1907. *Sylvilagus auduboni neomexicanus* Nelson, Proc. Biol. Soc. Washington, 20:83, July 22.

Nelson (N. Amer. Fauna, 29:230, August 31, 1909) listed under *Sylvilagus audubonii cedrophilus* Nelson an adult female, skin with skull (U. S. Nat. Mus., Biol. Surv. Coll., No. 108698) from fifteen miles south of Alpine, Texas. Nelson (*loc. cit.*) remarked that the "bleached" color of the back and the great lateral breadth of the tympanic bullae of No. 108698 were peculiarities not possessed by any other specimen examined. Geographically, the locality of capture is far south of other known occurrences of *S. a. cedrophilus* and approximately on the boundary separating the range of *S. a. minor* from that of *S. a. neomexicanus*. The large size, which may have induced Nelson to refer the specimen to *S. a. cedrophilus*, is not surprising considering that the individual is a female and fully adult. A combination of new and old fur on the upper parts presents a pattern that might be duplicated in other specimens of *S. a. neomexicanus*. The lateral inflation of the tympanic bullae can be interpreted as intergradation with the geographically adjacent *S. a. minor* to the south; *S. a. minor* has large bullae. There are no features otherwise which suggest that the specimen is anything other than *Sylvilagus audubonii neomexicanus* and we refer it to that subspecies.

Sylvilagus audubonii minor Mearns

1896. *Lepus arizonae minor* Mearns, Proc. U. S. Nat. Mus., 18:557, June 24.
1907. *S[ylvilagus]. a[uduboni]. minor*, Nelson, Proc. Biol. Soc. Washington, 20:83, July 22.

Nelson (N. Amer. Fauna, 29:230, August 31, 1909) listed, without comment, under *Sylvilagus auduboni cedrophilus* Nelson, a skin with skull inside (Amer. Mus. Nat. Hist., 5419, ♀ adult or subadult) from San Diego, Chihuahua, Mexico. We locate San Diego approximately 230 miles south and 60 miles east of El Paso, Texas. Thus, the specimen is from near the center of the geographic range of *Sylvilagus audubonii minor*. With the permission of Mr. G. G. Goodwin of the American Museum of Natural History we removed the skull. It differs in no essential features from those of other specimens of *S. a. minor*. For example, of specimens in the United States National Museum, Biological Surveys Collection, a female

(No. 132002) from Guzman in Chihuahua, and a male (No. 51020) from Santa Rosalia in the same state, are almost indistinguishable from the San Diegan specimen. The specimen is without external measurements but the length of the hind foot and length of ear from the notch in the dry state (80 and 57, respectively) agree with the corresponding measurements of *S. a. minor*. Color of the skin furnishes no diagnostic character as between *S. a. minor* and *S. a. cedrophilus*. We identify the specimen from San Diego as *Sylvilagus audubonii minor*.

Transmitted January 30, 1951.

23-7436

Two New Subspecies of Thomomys bottae from New Mexico and Colorado

BY

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Two New Subspecies of Thomomys bottae from New Mexico and Colorado

BY

KEITH R. KELSON

INTRODUCTION

IN CURRENT literature *Thomomys bottae fulvus* is recorded as occurring, in New Mexico, in the higher parts of areas on both sides of the Rio Grande, but not in the lowlands adjoining the river. The latter areas are occupied, from north to south successively, by *T. b. pervagus*, *T. b. connectens*, and *T. b. opulentis*. So far as I have been able to determine, no part of the geographic range of *T. b. fulvus* lies across the Rio Grande lowlands to form a connecting link between the populations on the eastern and western sides. Accordingly, a study was carried out to ascertain whether the specimens heretofore assigned to *T. b. fulvus* from east of the Rio Grande were morphologically distinct from those from the western side.

I am greatly indebted to Clarence Cottam, Stanley P. Young, Hartley H. T. Jackson, and Viola Schantz for the privilege of studying the specimens in the U. S. National Museum Biological Surveys collection, and to Seth B. Benson for the loan of topotypes and near topotypes of *Thomomys bottae ruidosae* in the Museum of Vertebrate Zoology, University of California. The study here reported upon was aided by a contract between the Office of Naval Research, Department of the Navy, and the University of Kansas (NR 161-791).

VARIATION

The geographic range of *T. b. fulvus* extends from the southern edge of the Grand Canyon, Arizona, in a broad belt southeastwardly into New Mexico and is the largest range ascribed to any of approximately 160 subspecies of *Thomomys bottae*. Throughout most of this region, pocket gophers are highly localized in distribution and, owing to the discontinuity of suitable habitat, are absent from extensive areas. As might be expected, microgeographic variation within the subspecies is great, and, beyond that, the wide latitude of individual variation is remarkably great, even for pocket gophers. Consequently, the determination of the extent of intrasubspecific morphological variation is difficult. In general, specimens from the

area of the type locality, San Francisco Mountain, Arizona, southeastwardly to western New Mexico show weak gradients in certain characters of taxonomic worth. For example, specimens from Springerville, Arizona, when compared with topotypes and near topotypes of *T. b. fulvus,* have, on the average, more procumbent incisors, larger and more angular skulls, larger tympanic bullae, and less evenly bowed (more angular) zygomatic arches. To judge from the specimens seen, these gradients, except for the increasing procumbency of the incisors, continue southeastward into that part of New Mexico west of the Rio Grande. Furthermore, in the same geographic direction, there is a faint increase in darkness of the pelage resulting from an almost imperceptible loss of the rufescent shades. Certain specimens within this range show marked departures morphologically, both on an individual and on a population basis, from more nearly "average" specimens from nearby localities. Some specimens from Luna, New Mexico, and two others from the head of the Mimbres River, are examples to the point. These animals are conspicuously darker than those from immediately adjacent localities and those from the head of the Mimbres River possess, in addition, distinctly more ridged and angular skulls as compared with nearby specimens of similar age. In western New Mexico there is a gradual and slight gradient in the shape of the zygomatic arches; in specimens obtained from successively more southern localities the maximum zygomatic breadth shifts posteriorly with reference to the long axis of the skull. Notwithstanding these gradients and microgeographic variants, at present it seems best to consider all of the material from Arizona and western New Mexico currently referred to *T. b. fulvus* as belonging to a single, highly variable subspecies.

Specimens from east of the Rio Grande heretofore assigned to *T. b. fulvus* differ collectively from those west of the river in possessing shorter exposed parts of the incisors, and more nearly straight-sided zygomatic arches as opposed to more evenly curved arches. Also the diffuse, saturate dorsal "stripe", so common among specimens from west of the Rio Grande, occurs rarely in specimens from east of the river and, in those in which it does occur, it is not pronounced. In specimens from east of the river the gradient of change in shape of the zygomatic arches is reversed from that in specimens west of the river. On the east side, in specimens obtained from progressively more southern localities, the maximum zygomatic breadth shifts anteriorly (excepting specimens of *Thomomys bottae*

ruidosae from Cloudcroft and Ruidoso and vicinity in the southern part of the state).

When Goldman (Jour. Washington Acad. Sci., 26 (3):115, March 15, 1936) named *Thomomys bottae internatus* with type locality at Salida, Colorado, he included in that subspecies Coloradan specimens from Gardner, and New Mexican specimens from Folsom, Oak Canyon ("near" Folsom), Sierra Grande, mouth of Trinchera Pass (all in Union County), and "Colfax County". A study of the specimens from these localities shows that those from New Mexico differ from those from Salida in smaller external measurements, smaller, more lightly constructed skull, proportionately longer and slenderer rostrum, more delicate nasals, larger (especially in width) tympanic bullae, and richer, more nearly saturate rufescent color. In these respects, so far as the material permits comparisons, the two specimens from Gardner, Colorado, are more nearly like those from Salida, but a specimen, No. 129285, from Fishers Peak, Colorado, more closely resembles the above-mentioned material from New Mexico. Six specimens from Halls Peak, Mora County, New Mexico, resemble those from northwestern Colfax County, except for slightly slenderer and less inflated (distally) nasals, slightly longer rostrum, and markedly darker color. The color of the specimens from Halls Peak is unlike that of any others from surrounding localities. The specimens from Halls Peak were taken in October, January, and February, and show a marked darkness of the rufescent shades and a much heavier overlay of black, lending an over-all appearance of dark brown to blackish color, rather than brightly rufescent as in seasonally comparable and summer-taken specimens from nearby localities.

Southwestwardly from Halls Peak, to as far as the Manzano Mountains (specimens from ten miles south of Mora; Pecos; and San Pedro), there is a decrease in size and angularity of the skull and in the procumbency of the incisors, and an increase, proportionately, in size of (especially length) and inflation of the tympanic bullae. From the Manzano Mountains southeastwardly, successively, in specimens from Corona, Jicarilla and environs, to as far as the Capitan Mountains, the skulls become progressively smaller, weaker, and less angular, with slenderer rostra; the incisors become more procumbent, tympanic bullae still smaller, and the pelage is increasingly rufescent. The specimens from the Manzano Mountains, in worn pelage, tend to be more pallid and less rufescent than the others in the series mentioned. These changes are additional to the increase

posteriorly of the zygomatic breadth already noted. Still farther south, specimens from Ruidoso and environs and Cloudcroft, Otero County, are abruptly different. They possess, as a series, the smallest, weakest skulls and the least angular zygomatic arches (being more evenly bowed) of any of the series of *Thomomys bottae* from east of the Rio Grande. In color, they are much darker than the others, being nearly black; the rufescent undertones are almost completely lacking. In the procumbency of the incisors they are about the same as the specimens from the Capitan Mountains. It should be noted, however, that the degree and direction of geographic gradients in cranial characters are not always directly correlated with geographic gradients in color.

In considering all of these specimens from east of the Rio Grande, it is apparent that on that side of the river geographic variation is much greater than on the west side and, in my opinion, it is sufficient to require the nominal recognition of two new subspecies.

NEW SUBSPECIES

Thomomys bottae cultellus new subspecies

Type.—Male, adult, skin and skull, no. 70919, U. S. National Museum (Biological Surveys collection), Halls Peak, Mora County, New Mexico; January 13, 1895, obtained by C. Barber.

Range.—Northern New Mexico and extreme southern Colorado east of the Sangre de Cristo Range.

Diagnosis.—Size small (see measurements); hind foot average for the species. Color: Ground color of upper parts Ochraceous-Tawny to Sudan Brown (capitalized color terms according to Ridgway, Color Standards and Color Nomenclature, 1912) heavily overlaid with black and dark brown lending over-all tone of Fuscous to Mummy Brown, and grading to Sayal Brown on flanks and inguinal region; underparts Snuff Brown to Cinnamon, usually purest on throat; ears medium in size with rounded or pointed pinnae; pinnae deeply pigmented; postauricular patches usually small, between Fuscous-Black and black; hind feet white, or almost so, distal to the ankle; forefeet same color as upper parts, but with whitish toes in some specimens; tail same color as upper parts or darker above, lighter below, but not distinctly bicolored, sometimes tipped with white. Skull: Size medium; moderately ridged for the species; rostrum moderately depressed distally; nasals weak, with but little inflation distally, extending posteriorly beyond dorsolateral spine of frontal, and together forming broad V posteriorly; zygomatic arches moderately spreading and with nearly straight and parallel sides; interparietal variable in shape, but averaging rectangular and longer than wide; upper incisors of moderate length and curvature; molariform dentition light; tympanic bullae having point of greatest ventral inflation anterior to midpoint of their ventral profile; basioccipital narrow and constricted; premaxillary tongues extending little beyond proximal tips of nasals.

Measurements.—Measurements in millimeters of 3 ♂♂ and 3 ♀♀ from the type locality are, respectively: Total length, 230, 209, 209, 219, —, 202; length of tail vertebrae, 76, 63, 74, 54, —, 58; basilar length (basion to Henselion), 35.5, 36.2, 34.5, 33.0, 31.7, 33.5; length of nasals, 15.5, 15.6, 14.1, 13.3, 12.3, 14.0; zygomatic breadth, 25.3, 25.0, 24.0, 23.7, —, 22.7; mastoidal breadth, 20.0, 19.2, 19.3, 19.6, 18.6, 19.2; interorbital breadth, 6.5, 6.6, 6.4, 6.5, 6.3, 6.4; alveolar length of upper molariform series (not of the alveoli themselves), 7.2, 8.0, 7.5, 7.5, 7.6, 7.5; extension of premaxillary tongues pos-

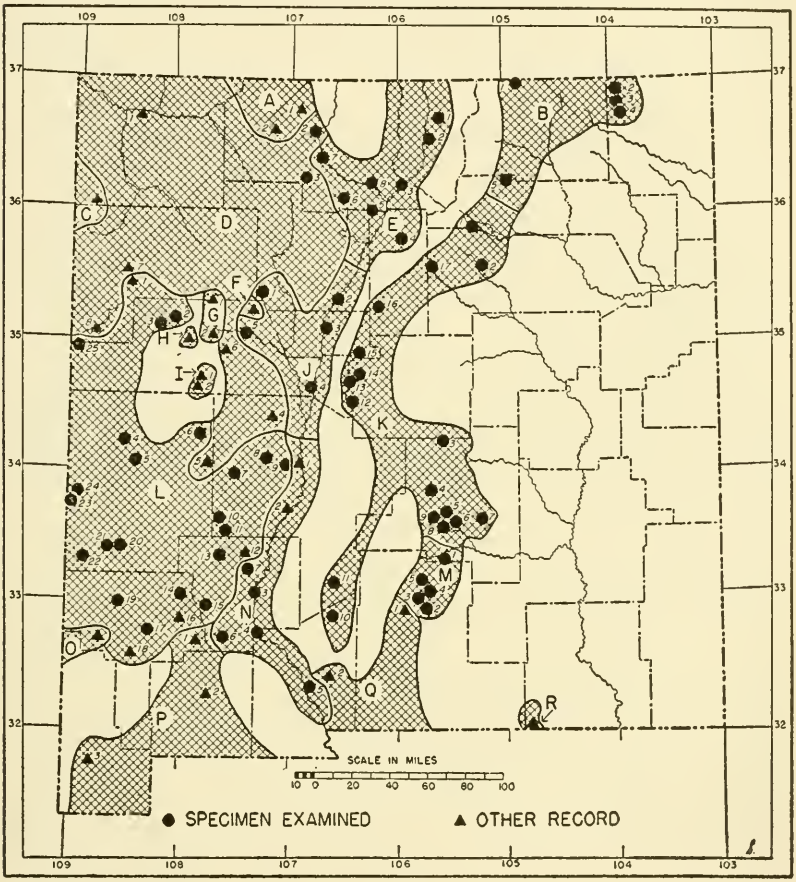

FIG. 1. Map showing the geographic distribution of subspecies of *Thomomys bottae* in New Mexico.

A. *T. b. apache*
B. *T. b. cultellus*
C. *T. b. peramplus*
D. *T. b. aureus*
E. *T. b. pervagus*
F. *T. b. pagatuae*
G. *T. b. planorum*
H. *T. b. morulus*
I. *T. b. collis*
J. *T. b. connectens*
K. *T. b. actuosus*
L. *T. b. fulvus*
M. *T. b. ruidosae*
N. *T. b. opulentis*
O. *T. b. alienus*
P. *T. b. toltecus*
Q. *T. b. lachuguilla*
R. *T. b. guadelupensis*

terior to nasals, 0.0, .2, .3, .2, .5, .8; length of rostrum (taken from dorsal point of union of the frontal, maxilla, and premaxilla to the distal tip of the nasal on the same side), 13.5, 13.8, 12.5, 12.7, 11.5, 13.0; breadth of rostrum, 7.5, 7.9, 7.7, 7.5, 7.1, 7.2.

Comparisons.—From *Thomomys bottae fulvus* from San Francisco Mountain and Springerville, Arizona, various localities in the Mogollon Mountains, and from Silver City, New Mexico, *T. b. cultellus* differs as follows: darker, less rufescent; nasals slenderer and less inflated distally; tympanic bullae less inflated near their mid-ventral point, but more so anteriorly; sides of zygomatic arches more nearly straight, as opposed to evenly bowed, and more lightly constructed; incisors averaging shorter; and lambdoidal crest less well developed, especially laterally.

From specimens of *Thomomys bottae internatus,* including the holotype, from Salida, Colorado, *T. b. cultellus* differs as follows: much darker, less rufescent; size smaller; nasals more delicate; skull smaller, less angular and more rounded; tympanic bullae less pointed ventrally.

Compared with the holotype, topotypes, and near topotypes of *T. b. pervagus, T. b. cultellus* differs as follows: much darker; size smaller; skull smaller, smoother, more lightly constructed; rostrum less depressed; tympanic bullae proportionately smaller and less inflated; incisors less procumbent; and basioccipital proportionately wider.

From specimens of *T. b. connectens* from Albuquerque, Belen, Laguna, and Juan Tafoya, New Mexico, *T. b. cultellus* differs as follows: much darker; size much smaller; skull smaller and more lightly constructed, but equally ridged and angular; rostrum narrower and more tapering; nasals less inflated distally; tympanic bullae much smaller, less inflated, incisors shorter and narrower.

For differences from *Thomomys bottae actuosus,* see accounts of that subspecies.

Remarks.—Although the specimens from the several localities in the Raton Mountains in northwestern Union County, are sharply distinct from those from Halls Peak in color and slightly so in cranial details, they and the specimen from Fishers Peak, Colorado, are here assigned to *Thomomys bottae cultellus.* This restricts the reported localities of occurrence of *T. b. internatus* to Salida and Garfield, Colorado. Specimens from Union County, New Mexico, and Fishers Peak, Colorado, may belong to an undescribed subspecies, but do not seem, at present, to warrant nominal recognition. Their color, closely resembling that of *T. b. internatus,* possibly indicates intergradation between *T. b. cultellus* and *T. b. internatus,* a possibility supported to some extent by the intermediacy of certain cranial characters. Although unseen by me, specimens from "near Cimarron", Colfax County, which were referred to *T. b. pervagus* by Hill (Jour. Mamm., 23(1):80, February 16, 1942) are probably

referable to *T. b. cultellus* since the locality of capture is east of, not west of, the Sangre de Cristo Range.

Specimens examined.—Total, 19; recorded on page 70.

Thomomys bottae actuosus new subspecies

Type.—Male, adult, skin and skull, No. 119053, U. S. National Museum (Biological Surveys collection), Corona, Lincoln County, New Mexico; October 13, 1902; obtained by James H. Gaut, original number 591.

Range.—Mountainous parts of central New Mexico between the Rio Grande and Pecos rivers from Mora southward to the San Andres and Capitan mountains.

Diagnosis.—Size medium for the species (see measurements). Color: upper parts Sayal Brown to Ochraceous-Tawny thinly overlaid with darker shades, purest on sides and flanks; underparts Clay Color or Cinnamon, purest on inguinal region and throat (specimens from the Manzano Mountains are darker, more saturate); ears medium in size and with rounded pinnae; pinnae moderately pigmented; postauricular patches large and near Fuscous-Black; forefeet and hind feet usually same color as upper parts or, when lighter, grading imperceptibly into color of upper parts; tail more or less distinctly bicolored, above same color as (or darker than) upper parts, and below much lighter (almost white), its tip all white. Skull: Size medium; comparatively smooth; rostrum moderately depressed distally; nasals moderately inflated distally, usually extending posteriorly not quite to level of dorsolateral spine of frontal, and together usually forming broad V posteriorly, but sometimes truncated or rounded; zygomatic arches with nearly straight and parallel sides, but tending in some specimens to be more wide-spread anteriorly than posteriorly; interparietal longer than wide, somewhat rectangular, but often convex anteriorly; upper incisors medium in length and curvature; molariform dentition medium in size; tympanic bullae moderately inflated, greatest inflation being at mid-point of ventral profile; basioccipital medium to wide and constricted or not; tongues of premaxillae extending well behind nasals.

Measurements.—Measurements in millimeters of 2 ♂ ♂ and 3 ♀ ♀ topotypes are, respectively: total length, 231, 214, 207, 211, 207; length of tail vertebrae, 80, 79, 77, 73, 70; length of hind foot, 31, 27, 27, 26, 27; basilar length, 34.0, 33.1, 31.6, 30.3, 29.9; length of nasals, 13.9, 13.2, ——, 12.3, 12.5; zygomatic breadth, 23.7, 23.6, 21.7, 20.9, 20.6; mastoidal breadth, 18.8, 18.9, 18.6, 17.3, 17.7; interorbital breadth, 6.9, 6.9, 6.8, 6.4, 6.9; alveolar length of upper molariform series, 8.0, 8.1, 7.5, 7.0, 7.5; extension of premaxillary tongues posterior to nasals, 1.5, 2.1, 1.4, .5, 1.0; length of rostrum, 13.6, 13.4, ——, 12.0, 12.4; breadth of rostrum, 7.8, 7.9, 7.5, 7.0, 7.1.

Comparisons.—From *T. b. cultellus* from Halls Peak, New Mexico, *T. b. actuosus* differs as follows: lighter, more ochraceous and less blackish; size larger; skull slightly smaller; rostrum more depressed; tympanic bullae slightly smaller; zygomatic arches less angular, especially pronounced anterolaterally; and incisors longer.

From *T. b. fulvus* from San Francisco Mountain, and Springerville, Arizona, various localities in the Mogollon Mountains, and from Silver City, New Mexico,

T. b. actuosus differs as follows: lighter; skull more angular; tympanic bullae larger; zygomatic arches nearly straight-sided as opposed to more or less evenly bowed; and incisors shorter.

From specimens of *T. b. pervagus* from localities given in the preceding account, *T. b. actuosus* differs in cranial characters much as *T. b. cultellus* differs from *T. b. pervagus.* In color, however, *T. b. actuosus* differs from *T. b. pervagus* in being paler, and markedly less ochraceous. In fresh pelage the difference is especially well marked.

From specimens of *T. b. connectens* from Albuquerque, Belen, Laguna, and Juan Tafoya, New Mexico, *T. b. actuosus* differs as follows: darker, more ochraceous as opposed to yellowish; tail usually same color as upper parts or darker as opposed to white or nearly so; size smaller; skull markedly smaller, more lightly constructed, and less angular; rostrum proportionately weaker and more tapered; zygomatic arches more widely spreading posteriorly; and incisors proportionately shorter.

From the holotype, topotypes, and other specimens throughout the range of *T. b. opulentis, T. b. actuosus* differs as follows: paler (the color of *T. b. actuosus* is intermediate between that of *T. b. connectens* and that of *T. b. opulentis*); skull slightly larger; nasals more inflated distally; tympanic bullae more inflated; and zygomatic arches less widely spreading posteriorly.

From topotypes of *T. b. ruidosae* from Ruidoso, New Mexico, and one near topotype (the latter from one mile south of Ruidoso), *T. b. actuosus* differs as follows: size larger; color markedly paler; skull larger and more angular; auditory bullae longer, especially the tympanic portion; zygomatic arches more angular and more nearly straight-sided as opposed to evenly bowed; and incisors less procumbent.

Remarks.—There is some evidence of intergradation between *T. b. actuosus* and *T. b. ruidosae.* Specimens from the Capitan Mountains are intermediate between the two subspecies in the procumbency of the incisors and shorter (than in "typical" *T. b. actuosus*) tympanic bullae. Nevertheless, these specimens are clearly referable to *T. b. actuosus* in the majority of their characters. Of four specimens from eight miles northwest of Cloudcroft, one, No. 215822, is intermediate in color between *T. b. actuosus* and *T. b. ruidosae;* another, No. 215820, is melanistic; No. 215821 has the color of topotypes of *T. b. ruidosae;* and No. 215823, an immature female, is even darker, especially dorsally, than topotypical *T. b. ruidosae.* Cranially, all four more closely resemble *T. b. ruidosae* to which they are here referred. Ten specimens from Cloudcroft, 9000 feet, Otero County, however, and one from ten miles north of Cloudcroft, show no evidence of intergradation and are readily referable to *T. b. ruidosae.* They seem to represent the extreme development of the characters of that subspecies, especially in their dark color and slender, tapering rostra.

Specimens examined.—Total, 62; recorded on page 70.

DISCUSSION

The materials from New Mexico that I have examined indicate that *T. b. opulentis* is the nearest morphologically to the theoretically ideal "connecting link" between *T. b. fulvus* west of the Rio Grande and the closely allied subspecies east of the river. In the sum total of the characters possessed by *T. b. opulentis* and which are not peculiar to it (as compared with the adjoining subspecies), it is probably more closely allied to the populations west of the river where the majority of its stations of occurrence are located. In the river bottoms farther north, *T. b. connectens* and *T. b. pervagus* are progressively more unlike the subspecies on either side of the river system. It is also noteworthy that the range of *T. b. pervagus* in the northern valleys of the Rio Grande is more or less completely separated by mountains from the other subspecies of the *bottae* complex, which occur to the east and west. The mountains are occupied by the northern species, *Thomomys talpoides.* The degree of separation is probably complete to the east between *T. b. pervagus* and *T. b. cultellus,* but probably incomplete to the west between *T. b. pervagus* and *T. b. aureus* and between *T. b. pervagus* and *T. b. apache.* Farther south, at the latitude of the range of *T. b. connectens,* the mountains form less of an east-west barrier, and *Thomomys talpoides* is absent. Still farther south, at the latitude of the range of *T. b. opulentis,* the mountains appear to be no barrier at all to the species, but, contrariwise, seem to provide the most suitable habitat. In brief, the degree of morphological intermediacy between subspecies occurring in the lowlands adjacent to the Rio Grande and those adjoining them on either side is directly proportional to the extent to which those mountain ranges paralleling the rivers act as barriers to gophers of the *bottae* complex.

RECORDS OF SPECIMENS

Figure 1 shows the geographic distribution, in New Mexico, of the specimens examined in the course of this study and also the peripheral localities of occurrence, as recorded in the literature, for all subspecies of *Thomomys bottae* occurring in the state.

In the following list, the italicized numbers included in parentheses refer to the localities shown in the accompanying map. The number following any statement of a locality is the number of specimens examined from that place. In any instance where this terminal number is lacking, it is to be understood that no specimens were examined by me. In an instance where an italicized numeral

in parentheses is wanting, it is to be understood that the locality is not shown on the map because the symbol for a second, nearby locality overlaps or covers the position of the first or because there is only one record of occurrence for that subspecies within the state.

Thomomys bottae internatus Goldman: 10 specimens examined: Colorado: Salida, 8; Gardner, 2.

Thomomys bottae apache Bailey: New Mexico: (*1*) Horse Lake; (*2*) Stinking Spring Lake.

Thomomys bottae cultellus Kelson: 19 specimens examined: Colorado: Fisher Peak, 1. New Mexico: (*1*) Long Canyon, 3 mi. N Catskill, 1; Hoskins Ranch [not found on any map], Colfax Co., 2; (*2*) Oak Canyon, 2; mouth Trinchera Pass, 1; (*3*) Folsom, 2; (*4*) Sierra Grande, 4; (*5*) Halls Peak, 6.

Thomomys bottae peramplus Goldman: New Mexico: Chusca Mts.

Thomomys bottae aureus Allen: 3 specimens examined: New Mexico: (*1*) Fruitland; (*2*) Chama River, near El Vado, 2; (*3*) Gallina, 1; (*4*) Riley; (*5*) St. Augustine Plains; (*6*) Acoma; (*7*) Wingate; (*8*) Pueblo of Zuni.

Thomomys bottae pervagus Merriam: 25 specimens examined: New Mexico: (*1*) Questa, 8000 ft., 4; (*2*) Arroyo Hondo, 7600 and 7900 ft., 4; (*3*) Rinconado, 5600 ft., 2; (*4*) 10 mi. N Santa Fe, 1; (*5*) Española, 5000 ft., 10; (*6*) Santa Clara Canyon, 2; (*7*) Chama Canyon, 6100 ft., Rio Arriba Co., 1; (*8*) 5 mi. E Abiquiu, 6100 ft., 1.

Thomomys bottae pagatuae Hooper: New Mexico: ½ mi. N Cebolleta, Valencia Co.

Thomomys bottae planorum Hooper: New Mexico: (*1*) Horace Mesa, 1½ mi. S Canyon Lobo Ranger Station, Valencia Co.; (*2*) 11 mi. SSE Grants, Valencia Co.

Thomomys bottae morulus Hooper: New Mexico: 8 mi. SE Paxton, Bill Porter's Ranch, Agua Fria Malpais, Valencia Co.; NW side Flagpole Crater, Valencia Co.

Thomomys bottae collis Hooper: New Mexico: (*1*) Shuman's Ranch, 30 mi. S Grants, Valencia Co.; (*2*) Point of Malpais, 12 mi. E Trechado, Valencia Co.

Thomomys bottae connectens Hall: 20 specimens examined: New Mexico: (*1*) Juan Tafoya, 2; (*2*) Bernalillo, 4; (*3*) Albuquerque, 4; (*4*) Belen, 6; (*5*) Laguna, 4.

Thomomys bottae actuosus Kelson: 63 specimens examined: New Mexico: (*1*) 10 mi. S Mora, 7300 ft., 4; (*2*) Las Vegas, 1; (*3*) Corona, 6; (*4*) Jicarilla Mts., 5; Capitan Mts., [(*5*) NW foothills, 6; (*6*) NW slope near summit of ridge, 2; (*7*) NE slope, 1; (*8*) SW foothills, 4; 5 mi. S and 5 mi. W Glencoe, 6000 ft., Lincoln Co., 1 (KU); (*9*) near W end summit of ridge, 4; SE slope, 2; NW slope near Raspberry Patch Spring, 1; Mt. Capitan, 1], 22; San Andres Mts. [(*10*) Bear Canyon, 3; summit of Divide-San Marcial Rd., 5100 ft., 2; (*11*) E slope, 1], 6; Manzano Mts. [(*12*) E slope near S end, 3; E slope, 2; (*13*) E slope, middle distance of range, 1; summit of ridge, 10,200 ft., 5; (*14*) Tejique, 1; (*15*) E foothills near N end, 1; Manzano Mts., 1], 14; (*16*) San Pedro, 3; (*17*) Pecos, 6800 ft., 2.

Thomomys bottae fulvus (Woodhouse): 134 specimens examined: Arizona: Aubrey Valley, 10 mi. S Pine Spring, 6000 ft., 2; Bill Williams Mt., 9000 ft., 2; NW slope Baker Butte, 7200 ft., 4; 17 mi. W Flagstaff, 7500 ft., 2; Fort Valley, 9 mi. NW Flagstaff, 2; Prescott, 5300 ft., 7; Prieto Plateau, 6; San Francisco Mt., 19; Springerville, 29. New Mexico: (*1*) Fort Wingate; (*2*) Mt. Sedgwick, 1; (*3*) Bear Ridge, Zuni Mts., 4; (*4*) Largo Canyon, 10 mi. SW Quemado, 2; (*5*) Datil Mts., 5; (*6*) Gallina Mts., 1; (*7*) Monica Canyon, 8000 and 9500 ft., San Mateo Mts., 2; (*8*) Copper Canyon, 8200 ft., Magdalena Mts., 1; (*9*) Water Canyon, 6500 ft., Magdalena Mts., 1; (*10*) Rio Alamosa, 15 mi. N Ojo Caliente, 6900 ft., 1; (*11*) Pleasanton, Socorro Co., 3; (*12*) 10 mi. E Chloride; (*13*) Fairview, 1; (*14*) head Rio Mimbres, 2; (*15*) "about" 4 mi. NW Kingston, 9500 ft., 2; (*16*) Rio Mimbres; (*17*) Silver City, 6200 ft., 12; (*18*) Burro Mts.; (*19*) Gila, Grant Co., 5; (*20*) "near" head Willow Cr., 7; (*21*) 15 mi. E

Mogollon, Mogollon Mts., 1; (22) Glenwood, 5000 ft., 1; (23) 6 mi. SW Luna, 7000 ft., 5; (24) Luna, 7000 ft., 3; (25) Zuni River, 1.

Thomomys bottae ruidosae Hall: 22 specimens examined: NEW MEXICO: (1) Ruidoso, 6700 ft., Lincoln Co., 5 (MVZ); 1 mi. S Ruidoso P. O., 7800 ft., Lincoln Co., 1 (MVZ); (2) Cloudcroft, 9000 ft., Otero Co., 10; (3) 8 mi. NW Cloudcroft, 7000 ft., Otero Co., 4; (4) 10 mi. N Cloudcroft, 1; (5) Mescalero, 1.

Thomomys bottae opulentis Goldman: 11 specimens examined: NEW MEXICO: (1) Socorro; (2) San Marcial; (3) Las Palomas, 4200 ft., 2; (4) Garfield, 5; (5) Las Cruces, 1; (6) Lake Valley, 5000 ft., 2; (7) Cuchillo, 4700 ft., 1.

Thomomys bottae alienus Goldman: NEW MEXICO: Redrock.

Thomomys bottae toltecus Allen: NEW MEXICO: (1) Rio Mimbres; (2) Deming; (3) Adobe Ranch, N base Animas Mts.

Thomomys bottae lachuguilla Bailey: NEW MEXICO: (1) Alamagordo, Otero Co.; (2) Organ, Dona Ana Co.

Thomomys bottae guadelupensis Goldman: NEW MEXICO: Dog Canyon, Guadelupe Mts., 6800 ft., Otero Co.

University of Kansas Museum of Natural History, Lawrence, Kansas. Transmitted February 1, 1951.

□

23-7437

A New Subspecies of Microtus montanus from Montana and Comments on Microtus canicaudus Miller

BY

E. RAYMOND HALL and KEITH R. KELSON

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A New Subspecies of Microtus montanus from Montana and Comments on Microtus canicaudus Miller

BY

E. RAYMOND HALL AND KEITH R. KELSON

IN 1949, for the Museum of Natural History of the University of Kansas, Mr. John A. White collected two specimens of the species *Microtus montanus* in the Bitterroot Valley of Montana, that did not fit the description of any named subspecies. These were laid aside until we could examine the additional specimens from Montana in the Biological Surveys collection in the United States National Museum, some of which previously had been reported by Bailey (N. Amer. Fauna, 17:31, June 6, 1900) under the name *Microtus nanus canescens* Bailey [=*Microtus montanus canescens*]. Our examination reveals that the animals from the Bitterroot and Flathead valleys belong to an heretofore unrecognized subspecies which is named and described below.

Microtus montanus pratincolus new subspecies

Type.—Female, adult, skull and skin, No. 34004, Univ. Kansas, Mus. Nat. Hist.; from 6 mi. E Hamilton, 3700 ft., Ravalli County, Montana; obtained on August 14, 1949, by John A. White; original number 477.

Geographic distribution.—Flathead and Bitterroot valleys of western Montana.

Diagnosis.—Size small for the species (see measurements). Color: Essentially as in *Microtus montanus nanus*. Skull: Small, slender, and comparatively smooth; rostrum moderately depressed distally; nasals moderately inflated distally and extending posteriorly not quite to tips of premaxillary tongues; nasals usually truncate posteriorly, but rounded in some individuals; premaxillary tongues terminating posteriorly in a short medial spine; zygomatic arches lightly constructed and usually more widely spreading posteriorly than anteriorly; interparietal comparatively long and terminating in a small, but distinct, medial spine, otherwise approximately rectangular in shape; exposed parts of upper incisors short and, for the species, only slightly procumbent; molar dentition weak and, in most specimens, especially so posteriorly; tympanic bullae large and well inflated, especially ventrolaterally; basioccipital narrow owing to the encroachment of the tympanic bullae.

Comparison.—Among named forms, *Microtus montanus pratincolus* most closely resembles *Microtus montanus nanus*. The geographic range of *M. m. nanus* adjoins that of *M. m. pratincolus* on three sides; there is no conspecific

subspecies adjoining the range of *M. m. pratincolus* on the north. From *M. m. nanus, M. m. pratincolus* differs as follows (measurements are all of males, those of *M. m. nanus* being of nine topotypes and near topotypes from central Idaho): size smaller (149 mm. as opposed to 165), tail shorter (37 as opposed to 39), hind foot shorter (19 as opposed to 20), upper molar series shorter (expressed as a percentage of basilar length, 25.5 as opposed to 26.3), mastoidal region broader (expressed as a percentage of basilar length, 48.6 as opposed to 46.7), braincase slightly more vaulted (depth of braincase expressed as a percentage of basilar length, 31.3 as opposed to 30.4) and more inflated laterally; tympanic bullae more inflated, this inflation being the most conspicuous difference between the two subspecies. The tympanic bullae of *M. m. pratincolus* have approximately a fourth more volume than those of *M. m. nanus.*

Remarks.—Northwardly in the Bitterroot Valley, specimens of *M. m. pratincolus* morphologically approach *M. m. nanus,* especially in the reduced degree of inflation of the tympanic portion of the bullae. On geographic grounds we think that the geographic range of *M. m. pratincolus* extends southward to the southern end of the Bitterroot Valley; we have not seen specimens from that area. Although we have not examined the specimen reported upon by Davis (Murrelet, 18:26, September 4, 1937) from Canyon Creek, "a few miles west of Hamilton", Montana, we think that it will be found to belong to *M. m. pratincolus.*

Our examination of specimens from localities in Montana east of the range here ascribed to *M. m. pratincolus* indicates that, among named kinds of *Microtus,* those specimens are best referred to *M. m. nanus.* These specimens are listed below under comparative materials. It should be mentioned here that although Bailey (*loc. cit.*) applied the name *Microtus nanus canescens* to Montanan specimens from Flathead Lake and Hot Springs Creek, the subspecies *M. montanus canescens* now is thought to be restricted to Washington and the adjoining part of British Columbia; *M. m. canescens* does not occur so far east as Montana.

Grateful acknowledgment is made to those persons in charge of the Biological Surveys collection for permission to study the specimens in that collection, and to the Kansas Endowment Association for support of the field work which yielded the specimens from six miles east of Hamilton, Montana. The study here reported upon was aided also by a contract between the Office of Naval Research, Department of the Navy, and the University of Kansas (NR 161-791).

Measurements.—The following measurements in millimeters are those of the holotype and the average, maximum, and minimum, respectively, of eleven

adult males from various places in the range of the subspecies. Except as noted below, we are unable to detect significant morphological differences in the populations sampled and believe that pooling of the measurements is justifiable in this case. Measurements are: Total length, 129, 149 (156-141); length of tail-vertebrae, 27, 37 (39-31); length of hind foot, 18, 19 (20-18) (all preceding measurements are those of the collectors); basilar length, 22.2, 24.5 (25.7-23.4); greatest length of nasals, 6.7, 6.9 (7.4-6.4); zygomatic breadth, 14.2, 14.6 (14.9-13.9); mastoidal breadth, 11.3, 11.8 (12.3-10.8); alveolar length of upper molar series, 6.0, 6.2 (6.5-5.9); depth of braincase (shortest distance from ventral surface of basioccipito-basisphenoidal suture to the dorsal surface of the cranium, and not perpendicular to the long axis of the skull), 7.7, 7.7 (7.9-7.5); width of rostrum, 4.7, 4.8 (5.0-4.6); interorbital breadth, 3.2, 3.4 (3.6-3.2). Measurements of females, other than those of the holotype, are not given owing to the lack of sufficient material. Females, however, do not appear to differ appreciably in measurements from males.

Specimens examined (in U. S. Nat. Mus., Biol. Surv. Coll., except as otherwise indicated).—Total, 26, all from Montana, as follows: *Sanders Co.:* Hotsprings Cr., 4. *Lake Co.:* end of W arm Flathead Lake, 5; Ravalli, 8. *Ravalli Co.:* Florence, 2; 8 mi. NE Stevensville, 4000 ft., 1; Corvallis, 4; 6 mi. E Hamilton, 3700 ft., 2(K. U.).

Comparative materials (in U. S. Nat. Mus., Biol. Surv. Coll.).—*Microtus montanus nanus:* Total, 72, as follows: IDAHO: *Lewis Co.:* Nez Perce, 3. *Idaho Co.:* Seven Devils Mts., 3550 ft., 3. *Custer Co.:* Challis, 7; Pahsimeroi Mts. (9300 ft., 8; 9700 ft., 4), 12. *Butte Co.:* Lost River Mts., 1. *Canyon Co.:* Nampa, 1; Bowmont, 1. *Ada Co.:* Boise, 1. *Blaine Co.:* Sawtooth Lake, 2; Alturas Lake, 3. *Owyhee Co.:* Three Cr., 3. *Minidoka Co.:* Heyburn, 2. *Bannock Co.:* Pocatello, 4. *Bear Lake Co.:* Montpelier Cr., 3. MONTANA: *Fergus Co.:* Big Snowy Mts., 11. *Gallatin Co.:* West Fork of West Fork, Gallatin River, 1. *Park Co.:* Lamar River, 7000 ft., 2; Gardiner, 1. *Sweetgrass Co.:* "near" head Big Timber Cr., Crazy Mts., 1; Big Timber Cr., 5200 ft., Crazy Mts., 1; 14 mi. S Big Timber, 1; West Boulder Cr., 18 mi. SE Livingston, 2; McLeod, 1. *Carbon Co.:* Beartooth Mts., 2; Beartooth Lake, 1. WYOMING: *Park Co.:* N end Lake, Yellowstone Nat'l Park, 2.

Microtus montanus canicaudus Miller

1897. *Microtus canicaudus* Miller, Proc. Biol. Soc. Washington, 11: 67, April 21, type from McCoy, Willamette Valley, Polk County, Oregon.

In 1938 when one of us (Hall, Proc. Biol. Soc. Washington, 51: 131-134, August 23, 1938) arranged several nominal species of *Microtus* as subspecies of the species *Microtus montanus, Microtus canicaudus* was not included because that writer had not examined representative specimens. In the U. S. Biological Surveys collection in the U. S. National Museum we have examined specimens of *M. m. canicaudus,* all from Oregon, as follows: Hood River (Catalogue Nos. 262583-262586); Canby (262577, 262578); Wapinitia (79985-79988); Sheridan (69779, 69780); McCoy (75834-75842, 77744); Salem (246736); Albany (161554); and Corvallis (242552). The four specimens from Wapinitia seem to be those that Bailey (N. Amer. Fauna, 17:29, June 6, 1900) listed as *Microtus montanus.*

The diagnostic characters mentioned by Miller in the original description (Proc. Biol. Soc. Washington, 11:67, April 21, 1897) included the following: size approximately the same as in *Microtus* [*montanus*] *nanus;* upper parts yellowish; tail usually nearly uniform grayish above and below; auditory bullae much inflated; lateral pits at posterior edge of bony palate unusually shallow. Because the tails of the original series were understuffed and variously rotated, they seemed to be less sharply bicolored than is the case, as shown by subsequently collected specimens. Otherwise we find that the characters mentioned above differentiate *canicaudus* from its nearest relatives, *Microtus montanus canescens* to the northward, *M. m. nanus* to the eastward, and *M. m. montanus* to the southward. In *canicaudus* we have noted one additional differential character; the interpterygoid space is acuminate anteriorly. In this feature and in each of the other features mentioned above, intergradation with *Microtus montanus nanus* is seen in the specimens from Hood River and Wapinitia. In the specimens from Hood River the auditory bullae are only slightly less inflated than in those topotypes of *canicaudus* having the smallest bullae; there is appreciable variation in size of the bullae in the topotypes. Even so, the minimum size of bullae among the topotypes is larger than the maximum size in the specimens from Wapinitia. The four specimens from Wapinitia have the yellowish color of *canicaudus* to a considerable degree, and show intergradation between *canicaudus* and *nanus* in depth of the palatal pits and shape of interpterygoid space. The slightly larger size of these specimens from Wapinitia suggests intergradation with *M. m. montanus.* The tympanic bullae in the specimens from Wapinitia seem to be smaller than in specimens of *canicaudus, nanus,* or *montanus.*

Because of the intergradation described above between *Microtus montanus nanus* and *M. canicaudus,* the latter should stand as *Microtus montanus canicaudus.*

Bailey (N. Amer. Fauna, 55:206, August 29, 1936) recorded *canicaudus* from Warm Springs in the Deschutes Valley of Oregon and from the state of Washington. Other authors also have recorded *canicaudus* from the state of Washington. Our examination of specimens leads us to conclude, as did Dalquest (Univ. Kansas Publ., Mus. Nat. Hist., 2:348, 349, April 9, 1948), that *canicaudus* does not occur in Washington. The reported occurrence of *M. canicaudus* at Warm Springs, Deschutes Valley, Oregon, seems to be the

result of an error in identification. The specimens concerned seem to be two *Microtus longicaudus mordax* (Nos. 207060 and 207082 U. S. N. M.). They are labeled as collected at "Warm Springs (Mill Cr.—20 Mi. W of)". Bailey's (*op. cit.*, fig. 46, p. 209) map showing the distribution in Oregon of *Microtus mordax mordax* [=*Microtus longicaudus mordax*] has a locality-dot at Warm Springs itself. Bailey seems to have erred; he should have placed this dot 20 miles farther west, we think. When preparing his map (*op. cit.*, fig. 43, p. 205) showing the geographic distribution of *Microtus canicaudus*, Bailey seems to have misidentified these same two specimens as *M. canicaudus*, and for them placed a locality-dot on his map 20 miles east (instead of west) of Warm Springs. In brief, Bailey probably did not see any specimens of *canicaudus* or specimens of any other subspecies of *Microtus montanus* from Warm Springs.

Transmitted February 15, 1951.

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23-7438

A New Pocket Gopher (Genus Thomomys) from Eastern Colorado

BY

E. RAYMOND HALL

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A New Pocket Gopher (Genus Thomomys) from Eastern Colorado

BY

E. RAYMOND HALL

THE pocket gophers of the species *Thomomys talpoides* in east-central Colorado have long been referred to the subspecies *Thomomys talpoides clusius* Coues with type locality at Bridger Pass, Wyoming. Recently, two subspecies, *T. t. attenuatus* and *T. t. rostralis* (see Hall and Montague, Univ. Kansas Publ., Mus. Nat. Hist., 5(3):25-32, February 28, 1951) were named from along the Wyoming-Colorado boundary with the result that the populations of *Thomomys talpoides* in east-central Colorado are separated from *T. t. clusius* of Wyoming by the geographic ranges now ascribed to the recently named *T. t. attenuatus* and *T. t. rostralis.* The subspecific identity of the animals from east-central Colorado thus is left in doubt. Examination of pertinent materials was made in the expectation that the names *Thomomys talpoides macrotis* F. W. Miller (Proc. Colorado Mus. Nat. Hist., 9:41, December 14, 1930) and *Thomomys talpoides cheyennensis* Swenk (Missouri Valley Fauna, 4:5, March 1, 1941) would apply to the specimens, the identity of which is in doubt. This examination discloses instead, as set forth in more detail below, that neither of the two names mentioned immediately above does apply; the Coloradan specimens in question are referable to an heretofore unrecognized subspecies which may be named and described as follows:

Thomomys talpoides retrorsus new subspecies

Thomomys clusius, Warren, The Mammals of Colorado, G. P. Putnam's Sons, New York, p. 80, 1910; Cary, N. Amer. Fauna, 33:132, August 17, 1911.

Thomomys talpoides clusius, Bailey, N. Amer. Fauna, 39:100, November 15, 1915; F. W. Miller, Proc. Colorado Mus. Nat. Hist., 9:41, December 14, 1930; Warren, The Mammals of Colorado, Univ. Oklahoma Press, Norman, p. 162, 1942.

Type.—Male, subadult, skull and skin, No. 69840 Biological Surveys Collection, U. S. Nat. Hist.; from Flagler, Kit Carson County, Colorado; obtained on November 26, 1894, by Clark P. Streator; original No. 4460.

Range.—Western end of the Arkansas Divide in Colorado from eight miles south of Seibert westward to Colorado Springs.

Diagnosis.—Size medium (see measurements); upper parts grayish brown; underparts lighter; skull small; tympanic bullae moderately inflated and angular anterolaterally; interpterygoid space narrowly U-shaped; pterygoid hamuli without transverse enlargement; nasals truncate posteriorly; premaxillary tongues projecting posteriorly behind nasals for distance of eight-tenths (0.5-1.1) of a millimeter.

Comparisons.—In comparison with *T. t. fossor* and *T. t. rostralis*, which occur farther west, selected differences of *T. t. retrorsus* are: lighter color; larger skull; more inflated tympanic bullae; greater relative (to length of skull) breadth across upper incisors, rostrum, and zygomata. The difference in color is greater in comparison with *fossor* than with *rostralis*.

In comparison with *T. t. macrotis* (specimens from the type locality), *T. t. retrorsus* is indistinguishable in color, length of tail, and length of tooth-row, but averages smaller in all other measurements. There is no overlap in length of body, basilar length, zygomatic breadth, mastoidal breadth or length of nasals. The temporal ridges, which mark the limits of the temporal muscles, are straight as opposed to curved and are lower. The tympanic bullae are more angular anterolaterally in *T. t. retrorsus*.

From *T. t. attenuatus* to the north, *T. t. retrorsus* differs in darker (more brown) color, consistently longer body, relatively (to length of skull) shorter rostrum and nasals. Linear measurements of the two latter structures and length of tail are approximately the same in the two subspecies but all other measurements average more in *T. t. retrorsus*. Also in the latter the temporal lines are approximately parallel instead of being bowed outward in their middle extent and instead of being more widely separated posteriorly than anteriorly.

From *T. t. cheyennensis* to the northeast, *T. t. retrorsus* differs in slightly darker (more brownish) color, consistently shorter body and rostrum, usually a more narrowly V-shaped interpterygoid space, and smaller average dimensions of the skull, notably in mastoidal breadth and length of the rostrum.

Remarks.—Miller's (Proc. Colorado Mus. Nat. Hist., 9:42, December 14, 1930) mention of a specimen taken on November 9, 1930, "near the head of Beaver Creek in extreme northeastern Elbert County" refers to the specimen, No. 2426 Colo. Mus. Nat. Hist., which is labeled as "8 mi. N. E. Agate, Elbert Co., Colo." Specimens from Colorado Springs, in the collection of the late E. R. Warren, have not been examined but the fact that Cary, Warren 1942, and Bailey (see under synonymy above) each referred the specimens to *clusius* instead of to the darker *fossor* gives basis for tentatively referring the specimens to *T. t. retrorsus*.

Grateful acknowledgment is made to those persons in charge of the mammal collections of the Denver Museum of Natural History and the Biological Surveys collection of mammals in the United States National Museum for permission to examine and report upon the material listed below (see specimens examined). The study

here reported upon was aided also by a contract between the Office of Naval Research, Department of the Navy, and the University of Kansas (NR 161-791). Essential comparative materials were obtained with assistance from the Kansas University Endowment Association.

Measurements.—Measurements of the type, a male, are followed by the measurements of three adult females (69835, 69839 and 69838) from the type locality. Total length, 216, 207, 210, 200; length of tail, 59, 58, 64, 56; length of hind foot, 28, 28, 28, 26; basilar length of skull, 32.8, 32.2, 32.3, 30.8; zygomatic breadth, 23.1, 22.5, ——, 20.5; least interorbital breadth, 6.0, 6.7, 6.2, 6.1; mastoidal breadth, 18.2, 18.8, 17.7, 17.7; length of nasals, 13.0, 13.7, 13.9, 14.0; breadth of rostrum, 7.6, 7.9, 7.4, 7.2; length of rostrum, 14.8, 15.6, 15.7, 16.0; alveolar length of maxillary tooth-row, 7.6, 7.2, 7.7, 7.6.

Specimens examined.—Total number, 13, all from Colorado, as follows: *Elbert County* (Colorado Mus. Nat. Hist. [= Denver Mus. Nat. Hist.]): Bijou Creek, "near El Paso Co. line", 3; 8 mi. NE Elbert, 1. *Lincoln Co.* (U. S. Biol. Surv. Coll.): Limon, 1. *Kit Carson Co.* (U. S. Biol. Surv. Coll.): Flagler, 7; 8 mi. S Seibert, 1.

Transmitted, February 28, 1951.

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23-7439

Mammals Taken Along the Alaska Highway

BY

ROLLIN H. BAKER

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Mammals Taken Along the Alaska Highway

BY

ROLLIN H. BAKER

INTRODUCTION

Mammals from along the Alaska Highway were obtained for the University of Kansas Museum of Natural History in the summers of 1947 and 1948 by Mr. J. R. Alcorn, field representative of the Museum. He and his family visited Alberta, British Columbia, the Yukon Territory and Alaska in an automobile and trailer from June 9, 1947, to September 6, 1947, and again from June 8, 1948, to August 24, 1948. In 1947, considerable time was spent by Alcorn in Alaska; trips were made on the Steese Highway to Circle and on the Glenn Highway to Anchorage. In 1948, most of the collecting was done in British Columbia and in the Yukon Territory but a side trip was taken to Haines, Alaska. The collecting stations are shown in figure 1. Alcorn's 1,252 specimens include several large series from areas where few or no mammals had been taken previously. Time spent at each collecting station was of short duration (usually less than three days) and although 56 species and subspecies of mammals are represented in the collections, it is recognized that not all of the kinds of mammals at any one locality were taken.

For the loan of comparative mammalian material, grateful acknowledgment is made to officials of the following institutions: California Academy of Sciences; Biological Surveys collection of the U. S. National Museum; Provincial Museum, Victoria, B. C.; National Museum of Canada. The promptness of officials of the game commissions of the provinces and territories concerned, in providing permits for collecting also is acknowledged. A part of the funds for field work was made available by a grant from the Kansas University Endowment Association. Elevations above sea level are given in feet. Capitalized color terms refer to those in Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912.

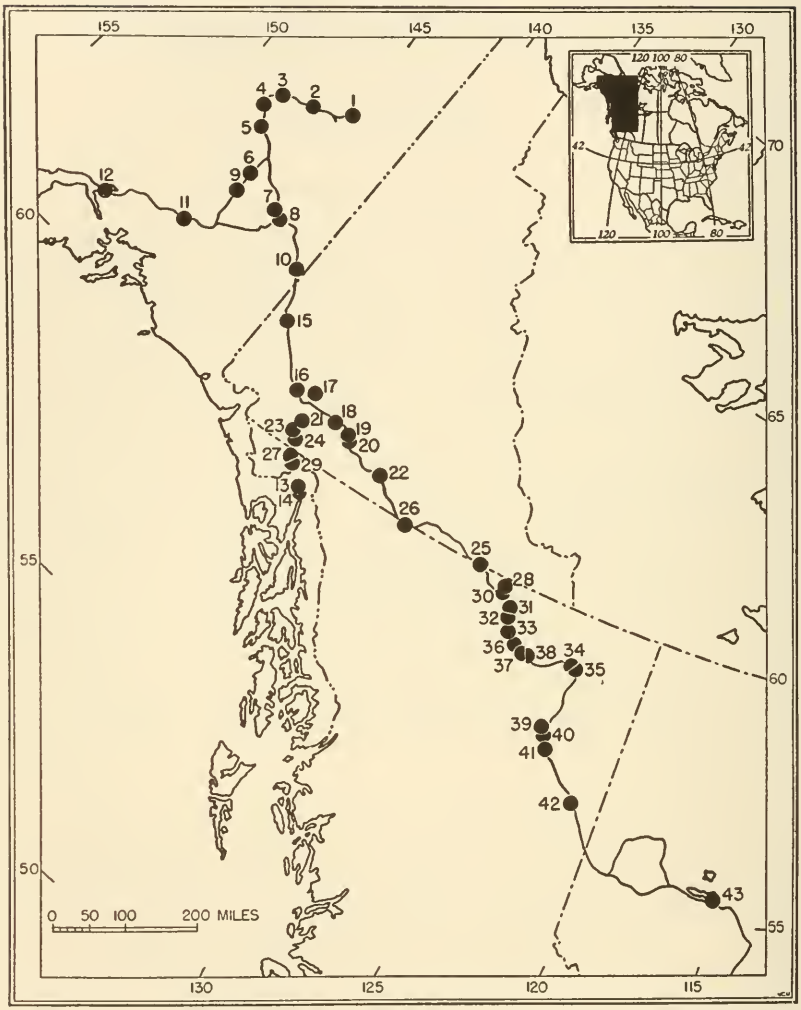

FIG. 1. Map showing localities where J. R. Alcorn collected mammals in Alaska, Yukon Territory, British Columbia, and Alberta, in 1947 and 1948.

COLLECTING LOCALITIES SHOWN IN FIGURE 1.

ALASKA

1. Circle.
2. Twelve Mile Summit, Steese Highway.
3. Chatanika River, 14 mi. E and 25 mi. N Fairbanks.
4. 1 mi. SW Fairbanks.
5. North side Salcha River, 25 mi. S and 20 mi. E Fairbanks.
6. Richardson Highway, 32 mi. S and 4 mi. W Big Delta.
7. Yerrick Creek, 21 mi. W and 4 mi. N Tok Junction.
8. Tok Junction.
9. Fish Creek, 5 mi. N and 1 mi. E Paxson.
10. East side Deadman Lake, 15 mi. SE Northway.
11. Glenn Highway, 6 mi. WSW Snowshoe Lake.
12. 1 mi. NE Anchorage.
13. East side Chilkat River, 9 mi. W and 4 mi. N Haines.
14. 1 mi. S Haines.

YUKON TERRITORY

To avoid undue crowding, or overlapping, of symbols, two or more collecting localities, in some instances, are represented by a single symbol (solid circle) in figure 1.

15. Junction Grafe and Edith Creeks.
16. 6 mi. SW Kluane.
17. East side Aishihik River, 17 mi. N Canyon.
18. 25 mi. NW Whitehorse.
19. 2 mi. NNW Whitehorse.
    McIntyre Creek, 3 mi. NW Whitehorse.
    1 mi. NE Whitehorse.
    ½ mi. W Whitehorse.
20. West side Lewes River, 2 mi. S Whitehorse.
21. Marshall Creek, 3 mi. N Dezadeash River.
    Champagne, North side Dezadeash Lake.
    SW end Dezadeash Lake.
22. 5 mi. W Teslin River, 16 mi. S and 53 mi. E Whitehorse.
    2 mi. W Teslin River, 16 mi. S and 56 mi. E Whitehorse.
    West side Teslin River, 16 mi. S and 58 mi. E Whitehorse.
    East side Teslin River, 16 mi. S and 59 mi. E Whitehorse.
23. Unahini River, 5 mi. N and 1 mi. E Dalton Post.
    Unahini River, 3 mi. N and 1 mi. E Dalton Post.
24. 1½ mi. E Tatshenshini River, 1½ mi. S and 3 mi. E Dalton Post.

BRITISH COLUMBIA

25. 1 mi. NW junction of Irons Creek and Liard River.
26. Screw Creek, 10 mi. S and 50 mi. E Teslin.
27. 15 mi. NW Kelsall Lake.
    Stonehouse Creek, 5½ mi. W junction Stonehouse Creek and Kelsall River.
28. 14 mi. N Fort Halkett, West side Smith River.
29. West side Mt. Glave, 14 mi. S and 2 mi. E Kelsall Lake.
30. North side Liard River, Fort Halkett.
31. Hot Springs, 3 mi. WNW junction Trout River and Liard River.
    North side Liard River, ½ mi. W junction Trout River and Liard River.
    ¼ mi. S junction Trout River and Liard River.
32. 12 mi. S junction Trout River and Liard River.
33. NE end Muncho Lake.
    SE end Muncho Lake.
34. 10 mi. W Fort Nelson.
35. North side Muskwa River, 4 mi. W Fort Nelson.
36. South side Toad River, 10 mi. S and 21 mi. E Muncho Lake.
37. Summit Pass, 10 mi. S and 70 mi. W Fort Nelson.
38. North Fork Tetsa River, 4 mi. ENE Summit Pass.
39. East side Minaker River, 1 mi. W Trutch.
40. Buckinghorse River, 94 mi. S Fort Nelson.
41. Beatton River, 115 mi. S Fort Nelson.
42. 5 mi. W and 3 mi. N Fort St. John.

ALBERTA

43. Assineau River, 10 mi. E and 1 mi. N Kinuso.

ACCOUNTS OF SPECIES

Sorex cinereus cinereus Kerr

Cinereous Shrew

Sorex arcticus cinereus Kerr, Animal Kingdom, p. 206, 1792. (Type from Fort Severn, Ontario, Canada.)
Sorex cinereus cinereus Jackson, Jour. Mamm., 6:56, February 9, 1925.

Specimens examined.—Total 56, as follows: *Alaska:* Chatanika River, 700 ft., 14 mi. E and 25 mi. N Fairbanks, 3; N side Salcha River, 600 ft., 25 mi. S and 20 mi. E Fairbanks, 10; Yerrick Creek, 21 mi. W and 4 mi. N Tok Junction, 2; E side Deadman Lake, 1800 ft., 15 mi. SE Northway, 1. *Yukon Territory:* 6 mi. SW Kluane, 2550 ft., 1; McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 2; W side Lewes River, 2150 ft., 2 mi. S Whitehorse, 2; SW end Dezadeash Lake, 4; 1½ mi. S and 3 mi. E Dalton Post, 2500 ft., 10. *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 9; Hot Springs, 3 mi. WNW jct. Trout River and Liard River, 6; ¼ mi. S jct. Trout River and Liard River, 4; 5 mi. W and 3 mi. N Fort St. John, 1. *Alberta:* Assineau River, 1920 ft., 10 mi. E and 1 mi. N Kinuso, 1.

Remarks.—Shrews from extreme northwestern British Columbia (Stonehouse Creek) average slightly larger than typical *S. c. cinereus,* especially in length of tail. These animals show definite evidence of intergradation with the larger subspecies, *S. c. streatori,* but are referable to *S. c. cinereus.* The pallor of some shrews from east-central Alaska (Chatanika River and Salcha River) suggests intergradation with the pale *S. c. hollisteri.*

Alcorn found the cinereous shrew at most of his trapping stations. It was captured in mouse traps baited with "chewed" rolled oats; one was taken in a trap baited with a grasshopper. Rand (1944:35) and Alcorn each found this shrew to be one of the commoner mammals along the Alaska Highway, but Alcorn did not find it to be so abundant as some of the rodents in areas in which he trapped. The cinereous shrew was taken principally in moist woodlands, grassy areas, and adjacent to water. One female taken on July 18 was lactating.

Sorex cinereus streatori Merriam

Cinereous Shrew

Sorex personatus streatori Merriam, N. Amer. Fauna, 10:62, December 31, 1895. (Type from Yakutat, Alaska.)
Sorex cinereus streatori Jackson, Jour. Mamm., 6:56, February 9, 1925.

Specimens examined.—Total 19, as follows: *Alaska:* E side Chilkat River, 100 ft., 9 mi. W and 4 mi. N Haines, 10; 1 mi. S Haines, 5 ft., 9.

Remarks.—Average and extreme external measurements of the nine adult specimens from 1 mile south of Haines are as follows: Total length, 103 (98-105); tail, 45 (43-46); and condylobasal length, 16.2 (16.0-16.4). Corresponding measurements of an adult specimen (No. 1676, UKMNH) from Sitka, Alaska, are 108, 47, and 16.5. Measurements of ten adult specimens from the Chilkat River, 9 miles west and 4 miles north of Haines, are 100 (91-106), 44 (40-50), 16.0 (15.5-16.5). The slightly smaller average size of the latter specimens indicates a trend toward the smaller S. *c. cinereus,* which occurs farther inland. Skulls of some of the specimens from the Chilkat River have a more slender rostrum than those of the specimens from 1 mile south of Haines, and more nearly resemble S. *c. cinereus* in this respect. Evidently, as indicated by Jackson (1928:54), S. *c. streatori* occupies only an extremely narrow strip of mainland in the vicinity of Haines.

Sorex cinereus hollisteri Jackson

Cinereous Shrew

Sorex cinereus hollisteri Jackson, Jour. Mamm., 6:55, February 9, 1925. (Type from St. Michael, Alaska.)

Specimens examined.—Two from *Alaska:* 1 mi. NE Anchorage, 100 ft.

Remarks.—Both specimens of this pale subspecies were trapped, along with six *Clethrionomys* and one *Mus,* in a grassy area bordered on one side by the road and on the other by a spruce forest. No. 21069, ♂ ?, taken on August 21, is in molt, with one patch of new fur on the rump and another along the midline of the nape and shoulders.

Sorex obscurus obscurus Merriam

Dusky Shrew

Sorex obscurus Merriam, N. Amer. Fauna, 10:72, December 31, 1895. (Type from near Timber Creek, altitude 8200 ft., Salmon River Mountains, now Lemhi Mountains, 10 miles west of Junction, Lemhi County, Idaho.)

Specimens examined.—Total 12, as follows: *Yukon Territory:* McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 1; SW end Dezadeash Lake, 2; 1½ mi.

S and 3 mi. E Dalton Post, 2500 ft., 1. *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 4; W side Mt. Glave, 4000 ft., 14 mi. S and 2 mi. E Kelsall Lake, 1; Hot Springs, 3 mi. WNW jct. Trout River and Liard River, 1. *Alberta:* Assineau River, 1920 ft., 10 mi. E and 1 mi. N Kinuso, 2.

Remarks.—Some of the shrews taken in extreme southwestern Yukon Territory (1½ miles south and 3 miles east of Dalton Post) and in extreme northwestern British Columbia (Stonehouse Creek and Mt. Glave) show evidence of intergradation with the coastal subspecies, *S. o. alascensis,* in length of hind foot. These individuals have a long hind foot (14 and 15); the hind feet of specimens from the other localities listed measure 13 and 14.

Alcorn, like Rand (1944:35), found the dusky shrew to be less common than the cinereous shrew; both were taken in the same trap lines. The dusky shrew was taken at a higher altitude (4000 feet, on Mt. Glave) than the cinereous shrew.

Sorex obscurus shumaginensis Merriam

Dusky Shrew

Sorex alascensis shumaginensis Merriam, Proc. Washington Acad. Sci., 2:18, March 14, 1900. (Type from Popof Island, Shumagin Islands, Alaska.)

Sorex obscurus shumaginensis J. A. Allen, Bull. Amer. Mus. Nat. Hist., 16:228, July 12, 1902.

Specimens examined.—Total 3, as follows: *Alaska:* 1 mi. NE Anchorage, 100 ft., 1; Glenn Highway, 6 mi. WSW Snowshoe Lake, 2.

Remarks.—These three shrews, in comparison with those referred to *S. o. obscurus,* are paler, and the one complete skull has a slightly higher braincase. All of the specimens were obtained in grassy areas adjacent to the roadway.

Sorex obscurus alascensis Merriam

Dusky Shrew

Sorex obscurus alascensis Merriam, N. Amer. Fauna, 10:76, December 31, 1895. (Type from Yakutat, Alaska.)

Specimens examined.—Total 22, as follows: *Alaska:* E side Chilkat River, 100 ft., 9 mi. W and 4 mi. N Haines, 12; 1 mi. S Haines, 5 ft., 10.

Sorex palustris navigator (Baird)

Water Shrew

Neosorex navigator Baird, Report Pacific R. R. Survey, 8, pt. 1, Mammals, p. 11, 1857. (Type from near head of Yakima River, Cascade Mountains, Washington.)

Sorex (Neosorex) palustris navigator Merriam, N. Amer. Fauna, 10:92, December 31, 1895.

Specimens examined.—Total 20, as follows: *Alaska:* E side Chilkat River, 100 ft., 9 mi. W and 4 mi. N Haines, 2. *Yukon Territory:* McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 11; SW end Dezadeash Lake, 2; 1½ mi. S

and 3 mi. E Dalton Post, 2500 ft., 3. *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 2.

Remarks.—Those males with worn teeth seem to have a slightly longer and deeper rostrum with a larger, more inflated cranium than specimens of *S. p. navigator* from Washington, but in other ways resemble typical *S. p. navigator.* An adult male, with slightly worn teeth, from Dezadeash Lake has sagittal and lambdoidal crests. All of the water shrews were taken in July and early August and at the edge of water in traps baited with rolled oats. None of the females had embryos.

Myotis lucifugus lucifugus (LeConte)

Little Brown Bat

Vespertilio lucifugus LeConte, McMurtrie's Cuvier, Animal Kingdom, vol. 1, appendix, p. 431, 1831. (Type from Georgia; probably the LeConte plantation, near Riceboro, Liberty County.)
Myotis lucifugus Miller, N. Amer. Fauna, 13:59, October 16, 1897.

Specimens examined. — Thirty-eight from British Columbia: NE end Muncho Lake.

Remarks.—The 38 bats were from a colony of approximately 75 individuals, found on the south side of a house. The paper was loose and had buckled in numerous places allowing room for the bats to ensconce themselves between the paper and outside wall.

Myotis lucifugus alascensis Miller

Little Brown Bat

Myotis lucifugus alascensis Miller, N. Amer. Fauna, 13:63, October 16, 1897. (Type from Sitka, Alaska.)

Specimens examined.—One from *British Columbia:* Screw Creek, 10 mi. S and 50 mi. E Teslin.

Remarks.—The specimen is considerably darker both above and below than either of two specimens of *M. l. alascensis* from Red Bluff Bay, Alaska. Alcorn searched ten frame buildings in an abandoned camp on the east side of Screw Creek, for bats and found only the one bat. It was above some droppings. No droppings were found in other buildings.

Ochotona collaris (Nelson)

Collared Pika

Lagomys collaris Nelson, Proc. Biol. Soc. Washington, 8:117, December 21, 1893. (Type from near head of Tanana River, about 200 miles south of Fort Yukon, Alaska.)
[*Ochotona*] *collaris* Trouessart, Catal. Mamm. viv. foss., p. 648, 1897.

Specimens examined.—Total 14, as follows: *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 1; W side Mt. Glave, 4000 ft., 14 mi. S and 2 mi. E Kelsall Lake, 13.

Remarks.—In comparing specimens obtained by Alcorn with published descriptions of *O. collaris* in Howell (1924:35), it appeared that measurable geographic variation might be present in this monotypic species. Accordingly, comparisons were made with materials in the Biological Surveys collection of the U. S. National Museum, the Provincial Museum, Victoria, B. C., and the National Museum of Canada. A comparison of specimens of similar ages showed that no subspecific separation is justified although animals from the Yukon Territory, British Columbia, and Northwest Territories, as compared with available material from Alaska, tend to be grayer in color and longer in total length with a slightly larger skull and greater alveolar length of molariform tooth-row in both upper and lower jaws.

Specimens used for comparison were from the following localities: *Alaska:* Mts. near Eagle (USBS), 15; 200 mi. S Fort Yukon (USBS), 2; Upper Little Delta River, Glacier Creek, Mt. Hayes region (USBS), 1; Glacier Creek, Mt. Hayes region (USBS), 3; Little Delta River, Slate Creek, Red Mt. Camp, Mt. Hayes region (USBS), 1; Muldron Glacier, Mt. McKinley (USBS), 2; Mt. McKinley (USBS), 3; Summit of Chugach Mts., on Richardson Highway, N of Valdez (USBS), 1; Chitina River Glacier (Nat. Mus. Canada), 3. *Yukon Territory:* McMillan Pass, Canol Road, mile 282 (Nat. Mus. Canada), 2; Rose River, Canol Road, mile 95 (Nat. Mus. Canada), 8; Tepee Lake (Nat. Mus. Canada), 1; Conrad (Nat. Mus. Canada), 1; near Teslin Lake (Nat. Mus. Canada), 1. *Northwest Territories:* headwaters of Caracajou River, Canol Road, mile 111E (Nat. Mus. Canada), 1. *British Columbia:* White Mt., Moose Arm, Tagish Lake, Atlin (Prov. Mus., Victoria, B. C.), 2.

Lepus americanus macfarlani Merriam

Varying Hare

Lepus americanus macfarlani Merriam, Proc. Washington Acad. Sci., 2:30, March 14, 1900. (Type from Fort Anderson, near mouth of Anderson River, Mackenzie, Canada.)

Specimens examined.—Total 3, as follows: *Yukon Territory:* W side Lewes River, 2150 ft., 2 mi. S Whitehorse, 1; 5 mi. W Teslin River, 2400 ft., 16 mi. S and 53 mi. E Whitehorse, 1. *British Columbia:* 14 mi. N Fort Halkett, W side Smith River, 1.

Remarks.—Alcorn reports seeing few hares on his two trips to Alaska. Near the Miniker River, a geologist told him that the num-

bers of these animals had steadily declined since 1943. One of three seen in a spruce forest on July 8, 1947, near Whitehorse was taken by Alcorn. A young one was captured in a rat trap in a building near the Teslin River on July 5 of the same year.

Tamiasciurus hudsonicus columbiensis A. H. Howell

Red Squirrel

Tamiasciurus hudsonicus columbiensis A. H. Howell, Proc. Biol. Soc. Washington, 49:135, August 22, 1936. (Type from Raspberry Creek, about 30 mi. SE of Telegraph Creek, northern British Columbia.)

Specimens examined.—Total 18, as follows: *Yukon Territory:* McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 1; W side Lewes River, 2150 ft., 2 mi. SW Whitehorse, 1; 2 mi. W Teslin River, 2400 ft., 16 mi. E Whitehorse, 1. *British Columbia:* 1 mi. NW jct. Irons Creek and Liard River, 1; ¼ mi. S jct. Trout River and Liard River, 3; S side Toad River, 10 mi. S and 21 mi. E Muncho Lake, 3; Summit Pass, 4200 ft., 10 mi. S and 70 mi. W Fort Nelson, 8.

Remarks.—Rand (1944:42) experienced difficulty in assigning subspecific names to red squirrels taken along the Alaska Highway in northern British Columbia. Some variability as found by Rand is noted in adults taken by Alcorn in this area. All of the specimens assigned to *T. h. columbiensis* have a darker tail and more tawny feet than *T. h. preblei.* The average of skulls of adults is smaller than the skull of an adult of *T. h. preblei* from Yerrick Creek, Alaska.

Alcorn obtained most of the squirrels in rat traps and steel traps, using "chewed" rolled oats as well as bits of fish and mouse bodies as bait.

Tamiasciurus hudsonicus petulans (Osgood)

Red Squirrel

Sciurus hudsonicus petulans Osgood, N. Amer. Fauna, 19:27, October 6, 1900. (Type from Glacier, White Pass, Alaska.)

T[amiasciurus]. hudsonicus petulans A. H. Howell, Proc. Biol. Soc. Washington, 49:136, August 22, 1936.

Specimens examined.—Total 7, as follows: *Alaska:* 1 mi. S Haines, 5 ft., 2. *Yukon Territory:* SW end Dezadeash Lake, 1; 1½ mi. E Tatshenshini River, 1½ mi. S and 3 mi. E Dalton Post, 4.

Remarks.—Specimens from extreme southwestern Yukon Territory appear to be referable to this subspecies. The one adult female (skull only, with body measurements) from the southwestern end of Dezadeash Lake has a shorter skull than does any adult female of *T. h. columbiensis.* No skins of adults are in the series, but the skins of three subadults have darker upper parts, a darker tail and less olivaceous sides than *T. h. columbiensis.*

Tamiasciurus hudsonicus preblei A. H. Howell

Red Squirrel

Tamiasciurus hudsonicus preblei A. H. Howell, Proc. Biol. Soc. Washington, 49:133, August 22, 1936. (Type from Fort Simpson, Mackenzie District, Northwestern Territories.)

Specimens examined.—Total 3, as follows: *Alaska:* Chatanika River, 700 ft., 14 mi. E and 25 mi. N Fairbanks, 1; N side Salcha River, 600 ft., 25 mi. S and 20 mi. E Fairbanks, 1; Yerrick Creek, 21 mi. W and 4 mi. N Tok Junction, 1.

Remarks.—In comparison with specimens of *T. h. hudsonicus* from Iskwasum Lake, District of the Pas, Manitoba, the squirrel from Yerrick Creek, an adult female, is larger and paler on the upper parts and tail.

The squirrel taken at Yerrick Creek was captured in a rat trap; Alcorn found these animals to be "fairly common" in that area. He obtained no evidence that the natives use them for food.

Marmota monax ochracea Swarth

Woodchuck

Marmota ochracea Swarth, Univ. California Publ. Zoöl., 7:203, February 18, 1911. (Type from Forty-mile Creek, Alaska.)

Marmota monax ochracea A. H. Howell, N. Amer. Fauna, 37:34, April 7, 1915.

Specimens examined.—Total 3, as follows: *British Columbia:* Hot Springs, 3 mi. WNW jct. Trout River and Liard River, 1; ¼ mi. S jct. Trout River and Liard River, 2.

Citellus parryii plesius (Osgood)

Parry Ground Squirrel

Spermophilis empetra plesius Osgood, N. Amer. Fauna, 19:29, October 6, 1900. (Type from Bennett City, head of Lake Bennett, British Columbia.)

Citellus paryii plesius A. H. Howell, N. Amer. Fauna, 56:97, May 18, 1938.

Specimens examined.—Total 42, as follows: *Alaska:* Richardson Highway, 2000 ft., 32 mi. S and 4 mi. W Big Delta, 5. *Yukon Territory:* 6 mi. SW Kluane, 2550 ft., 1; McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 1; 2 mi. NNW Whitehorse, 2100 ft., 1; 1 mi. NE Whitehorse, 1; ½ mi. W Whitehorse, 2150 ft., 1; SW end Dezadeash Lake, 1; 2 mi. W Teslin River, 2400 ft., 16 mi. S and 56 mi. E Whitehorse, 7; 1½ mi. E Tatshenshini River, 1½ mi. S and 3 mi. E Dalton Post, 3. *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 14; W side Mt. Glave, 4000 ft., 14 mi. S and 2 mi. E Kelsall Lake, 7.

Remarks.—The specimens vary much in color; most color variation is the result of wear and fading. In pallor of coloration the specimens taken on August 16 along the Richardson Highway, 32

miles south and 4 miles west of Big Delta, Alaska, show some resemblance to *C. p. ablusus,* which occurs to the westward, although in other diagnostic characters these specimens are typically *C. p. plesius.*

Specimens in early stages of molt were taken on July 3, 4, and 14; another specimen in an advanced stage of molt was obtained on July 10. One melanistic individual was taken one mile northeast of Whitehorse on July 11.

Alcorn found these ground squirrels locally abundant, especially in the vicinity of Whitehorse in Yukon Territory. A large population was observed along the highway west of the Teslin River; animals were seen for several miles along the road, principally in open coniferous forests where there was little or no underbrush. Alcorn caught several animals near the city dump at Whitehorse. Along the Richardson Highway he observed these ground squirrels almost continuously for approximately ten miles. He comments that the animals appeared to be more numerous in the man-cleared areas along the highway than in "unmolested areas farther back from the highway." Specimens were taken with collecting gun and in rat traps baited with "chewed" rolled oats.

Eutamias minimus borealis (J. A. Allen)

Least Chipmunk

Tamias asiaticus borealis J. A. Allen, Monogr. N. Amer. Rodentia, p. 793, August, 1877. (Type from Fort Liard, Mackenzie, Canada.)
Eutamias minimus borealis A. H. Howell, Jour. Mamm., 3:183, August 4, 1922.

Specimens examined.—Total 10, as follows: *British Columbia:* N side Muskwa River, 1200 ft., 4 mi. W Fort Nelson, 1; E side Minaker River, 1 mi. W Trutch, 5; Beatton River, 115 mi. S Fort Nelson, 1; 5 mi. W. and 3 mi. N Fort St. John, 1. *Alberta:* Assineau River, 1920 ft., 10 mi. E and 1 mi. N Kinuso, 2.

Remarks.—Specimens with worn pelage are conspicuously paler and grayer than those in fresh pelage. Chipmunks in early stages of molt with fresh pelage extending posteriorly to the middle of the dorsal part of the back were taken on June 19, 20, and 22; others in fresh pelage above, except for the hind quarters, were taken on June 15 and on September 2.

Alcorn found this species nowhere abundant; for example, in 187 museum special traps set near Charlie Lake, 5 miles west and 3 miles north of Fort St. John, in British Columbia, he took only one chipmunk.

Eutamias minimus caniceps Osgood

Least Chipmunk

Eutamias caniceps Osgood, N. Amer. Fauna, 19:28, October 6, 1900. (Type from Lake Lebarge, Yukon Territory.)
Eutamias minimus caniceps A. H. Howell, Jour. Mamm., 3:184, August 4, 1922.

Specimens examined.—Total 36, as follows: *Yukon Territory:* 6 mi. SW Kluane, 2550 ft., 2; McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 3; 2 mi. NNW Whitehorse, 2100 ft., 1; W side Lewes River, 2150 ft., 2 mi. S Whitehorse, 1; SW end Dezadeash Lake, 10; 5 mi. W Teslin River, 2400 ft., 16 mi. S and 53 mi. E Whitehorse, 1; W side Teslin River, 16 mi. S and 58 mi. E Whitehorse, 2; 1½ mi. S and 3 mi. E. Dalton Post, 2500 ft., 5. *British Columbia:* 1 mi. NW jct. Irons Creek and Liard River, 2; S side Toad River, 10 mi. S and 21 mi. E Muncho Lake, 6; Summit Pass, 4200 ft., 10 mi. S and 70 mi. W Fort Nelson, 3.

Remarks.—Some of the specimens taken between Summit Pass and Toad River show evidence of intergradation between the paler and grayer *E. m. caniceps* and the brighter and browner *E. m. borealis.* Rand (1944:41) also found evidence of intergradation between these two subspecies in this area.

Along the highway, Alcorn found this species to be somewhat more abundant in the Yukon Territory than in British Columbia. He often found the animals occupying abandoned road camps; seemingly they were more numerous in these areas than in undisturbed natural habitat.

Glaucomys sabrinus zaphaeus (Osgood)

Flying Squirrel

Sciuropterus alpinus zaphaeus Osgood, Proc. Biol. Soc. Washington, 18:133, April 18, 1905. (Type from Helm Bay, Cleveland Peninsula, southeastern Alaska.)
Glaucomys sabrinus zaphaeus A. H. Howell, N. Amer. Fauna, 44:43, June 13, 1918.

Specimens examined.—One from *Yukon Territory:* 1½ mi. S and 3 mi. E Dalton Post, 2500 ft.

Remarks.—Although comparative material is not available at this writing, descriptions in the literature indicate that this single adult female belongs to the coastal form, *G. s. zaphaeus.* In both color and in cranial and external measurements, this specimen appears to agree closely with descriptions given by Howell (1918:43) and by Cowan (1937:78 and 82), although its measurements are also in the range of those given for *G. s. alpinus* by Cowan (*loc. cit.*). It may be pointed out that Swarth (1936:402) regarded a specimen from 15 miles south of Atlin, British Columbia, as *G. s. alpinus.*

Measurements of Alcorn's specimen are as follows: total length, 331; tail, 143; hind foot, 42; ear from notch, 23; greatest length of

skull, 41.7; zygomatic breadth, 25.7; mastoid breadth, 21.7; length of nasals, 12.2; length maxillary tooth-row, 8.2; interorbital constriction, 8.2; and postorbital constriction, 9.0.

Castor canadensis sagittatus Benson

Beaver

Castor canadensis sagittatus Benson, Jour. Mamm., 14:320, November 13, 1933. (Type from Indianpoint Creek, 3200 ft., 16 mi. NE Barkerville, British Columbia.)

Specimens examined.—Two from *British Columbia:* Fort Halkett, N side Liard River.

Remarks.—Two beaver skulls obtained by Alcorn from trapper Johnny Pie appear to be of this subspecies. Anderson (1947:133) records this subspecies from the Liard River, in the area from which these specimens were taken. The trapper told Alcorn that he shot these two beavers in the winter of 1947-48 and hung the skulls in a tree.

Peromyscus maniculatus algidus Osgood

White-footed Mouse

Peromyscus maniculatus algidus Osgood, N. Amer. Fauna, No. 28:56, April 17, 1909. (Type from head of Lake Bennett, site of old Bennett City, British Columbia.)

Specimens examined.—Total 93, as follows: *Alaska:* E side Chilkat River, 100 ft., 9 mi. W and 4 mi. N Haines, 20; 1 mi. W Haines, 5 ft., 7. *Yukon Territory:* 6 mi. SW Kluane, 2550 ft., 10; McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 6; 2 mi. NNW Whitehorse, 2100 ft., 2; W side Lewes River, 2150 ft., 2 mi. S Whitehorse, 16; SW end Dezadeash Lake, 9; 1½ mi. S and 3 mi. E Dalton Post, 15. *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 8.

Remarks.—Specimens from the localities listed above are in the geographic range of *P. m. algidus* as outlined by Anderson (1947: 136). Specimens from the vicinity of Haines, Alaska, are slightly darker indicating intergradation with *P. m. hylaeus;* Osgood (1909a: 54 and 56) also noted that intergradation between *P. m. algidus* and *P. m. hylaeus* occurs in this area.

Peromyscus maniculatus borealis Mearns

White-footed Mouse

Peromyscus maniculatus borealis Mearns, Proc. Biol. Soc. Washington, 24:102, May 15, 1911. Substitute name for *P. m. arcticus* Mearns. (Type from Fort Simpson, Mackenzie, Canada.)

Specimens examined.—Total 214, as follows: *Yukon Territory:* 2 mi. W Teslin River, 2400 ft., 16 mi. S and 56 mi. E Whitehorse, 8; W side Teslin River, 2300 ft., 16 mi. S and 58 mi. E Whitehorse, 24; E side Teslin River, 2300 ft., 16 mi. S and 59 mi. E Whitehorse, 7. *British Columbia:* 1 mi. NW jct. Irons Creek and Liard River, 10; Hot Springs, 3 mi. WNW jct. Trout

River and Liard River, 6; N side Liard River, ½ mi. W jct. Trout River and Liard River, 13; ¼ mi. S jct. Trout River and Liard River, 20; SE end Muncho Lake, 5; S side Toad River, 10 mi. S and 21 mi. E Muncho Lake, 45; N side Muskwa River, 1200 ft., 4 mi. W Fort Nelson, 9; North Fork Tetsa River, 3900 ft., 4 mi. ENE Summit Pass, 13; Summit Pass, 4200 ft., 10 mi. S and 70 mi. W Fort Nelson, 17; E side Minaker River, 1 mi. W Trutch, 18; Beatton River, 115 mi. S Fort Nelson, 2; 5 mi. W and 3 mi. N Fort St. John, 7. *Alberta:* Assineau River, 1920 ft., 10 mi. E and 1 mi. N Kinuso, 10.

Remarks.—Specimens from 2 miles west of Teslin River resemble *P. m. borealis* more than *P. m. algidus* both in size of skull and in color, although I find it difficult to distinguish the specimens by color.

Alcorn, like Rand (1945:43), found the mouse in almost every habitat along the Alaska Highway. On the east side of the Minaker River, one mile west of Trutch, Alcorn took 26 *Peromyscus* and four *Microtus* in 70 museum special traps baited with chewed rolled oats, set in a grassy area where there were birches and clumps of willows. *Peromyscus* was usually abundant in old construction camps along the highway; on July 27 in 50 traps set under abandoned buildings at Summit Pass, Alcorn took 21 *Peromyscus.* Apparently, as Swarth (1936:402) notes, the white-footed mouse makes itself at home in such buildings, and local populations probably increase as a result of the artificial environment that provides favorable conditions for existence.

Neotoma cinerea drummondii (Richardson)

Bushy-tailed Wood Rat

Myoxus drummondii Richardson, Zool. Jour., 3:517, 1828. (Type probably from near Jasper House, Alberta, Canada.)
Neotoma cinerea drummondii Merriam, Proc. Biol. Soc. Washington, 7:25, April 13, 1892.

Specimens examined.—Total 4, as follows: *British Columbia:* Summit Pass, 4500 ft., 10 mi. S and 70 mi. W of Fort Nelson, 1; 5 mi. W and 3 mi. N Fort St. John, 3.

Remarks.—Wood rats were obtained at only two locations, Alcorn's field notes indicating that the animals were rare and spotty in distribution. Rand (1944:44) comments that the rats were "scarce north of the Lower Liard Crossing."

At both localities where specimens were taken, Alcorn noted first their characteristic droppings. At Summit Pass, droppings were found in a rock slide at the upper limit of timber line; one rat was taken. At the trapping station five miles west and three miles north of Fort St. John, droppings were found in and under an old abandoned building; four young (two prepared) and one adult were obtained.

Synaptomys borealis dalli Merriam

Northern Bog Lemming

Synaptomys (*Mictomys*) *dalli* Merriam, Proc. Biol. Soc. Washington, 10:62, March 19, 1896. (Type from Nulato, Alaska.)
Synaptomys borealis dalli A. B. Howell, N. Amer. Fauna, 50:24, (June 30) August 5, 1927.

Specimens examined.—Total 6, as follows: *Alaska:* E side Deadman Lake, 1800 ft., 15 mi. SE Northway, 1. *Yukon Territory:* McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 5.

Remarks.—The northern bog lemming is evidently not generally distributed along the Alaska Highway but may be locally numerous in cover of grass and sedge especially in marsh and bog habitat. Five specimens were obtained in a grassy area 30 feet wide by 60 feet long which was approximately 50 feet from McIntyre Creek in the Yukon Territory. In 22 mouse traps set the first night in this locality, three *Synaptomys,* six *Microtus* and one *Sorex* were taken. One additional *Synaptomys* was taken on each of the following two nights in the same area. At Deadman Lake, Alaska, one *Synaptomys* was taken in heavy sedge bordering a small pond.

Clethrionomys rutilus dawsoni (Merriam)

Dawson Red-backed Mouse

Evotomys dawsoni Merriam, Amer. Nat., 22:650, July, 1888. (Type from Finlayson River, a northern source of the Liard River, lat. 61° 30′ N, long. 129° 30′ W, Yukon, Canada.)
Clethrionomys rutilus dawsoni Rausch, Jour. Washington Acad. Sci., 40:135, April 21, 1950.

Specimens examined.—Total 126, as follows: *Alaska:* Chatanika River, 700 ft., 14 mi. E and 25 mi. N Fairbanks, 17; 1 mi. SW Fairbanks, 440 ft., 1; N side Salcha River, 600 ft., 25 mi. S and 20 mi. E Fairbanks, 15; 25 mi. S and 20 mi. E Fairbanks, 3; Yerrick Creek, 21 mi. W and 4 mi. N Tok Junction, 32; Tok Junction, 1600 ft., 1; E side Deadman Lake, 1800 ft., 15 mi. SE Northway, 9; 1 mi. NE Anchorage, 100 ft., 9; Glenn Highway, 6 mi. WSW Snowshoe Lake, 1; E side Chilkat River, 100 ft., 9 mi. W and 4 mi. N Haines, 2; 1 mi. S Haines, 5 ft., 2. *Yukon Territoy:* Jct. Grafe Creek and Edith Creek, 2; 6 mi. SW Kluane, 2250 ft., 4; 2 mi. NNW Whitehorse, 2100 ft., 2; W side Lewes River, 2150 ft., 2 mi. S Whitehorse, 6; SW end Desadeash Lake, 15. *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 1; S side Toad River, 10 mi. S and 21 mi. E Muncho Lake, 2; Summit Pass, 4500 ft., 10 mi. S and 70 mi. W Fort Nelson, 2.

Remarks.—Specimens from one mile northeast of Anchorage show little tendency toward *C. r. orca* from the Prince William Sound area (see Orr, 1945:73). One specimen from this locality is slightly darker than the others.

Red-backed mice were numerous in most localities where Alcorn trapped. A number of specimens were taken adjacent to and within abandoned road camps, where second growth vegetation was rank. As in the case of *C. gapperi,* he found *C. rutilus* in varied habitats.

Clethrionomys gapperi athabascae (Preble)

Red-backed Mouse

Evotomys gapperi athabascae Preble, N. Amer. Fauna, 27:178, October 26, 1908. (Type from Fort Smith, Slave Lake, Mackenzie District, Northwest Territories, Canada.)

Clethrionomys gapperi athabascae Harper, Jour. Mamm., 13:28, February 9, 1932.

Specimens examined.—Total 14, as follows: *British Columbia:* N side Muska River, 1200 ft., 4 mi. W Fort Nelson, 1; E side Minaker River, 1 mi. W Trutch, 3; 5 mi. W and 3 mi. N Fort St. John, 4. *Alberta:* Assineau River, 1920 ft., 10 mi. E and 1 mi. N Kinuso, 6.

Remarks.—These red-backed mice were taken in various habitats: grassy areas in aspen and poplar forest, heavy spruce forest with no undergrowth excepting lichens and moss, thick underbrush in river flood plain, and at the site of an old sawmill. The northwestern distribution of this species along the Alaska Highway as found by Alcorn is approximately the same as that found by Rand (1944:44).

Ondatra zibethicus spatulatus (Osgood)

Muskrat

Fiber spatulatus Osgood, N. Amer. Fauna, 19:36, October 6, 1900. (Type from Lake Marsh, Yukon, Canada.)

Ondatra zibethica spatulata Miller, N. Amer. Land Mann. 1911, p. 231, December 31, 1912.

Specimens examined.—Total 2, as follows: *Alaska:* N side Salcha River, 600 ft., 25 mi. S and 20 mi. E Fairbanks, 1; E side Deadman Lake, 1800 ft., 15 mi. NE Northway, 1.

Remarks.—One muskrat was shot in an old beaver pond on the north side of the Salcha River. A skull from a carcass, that had been left by a trapper the previous winter, was obtained at Deadman Lake.

Phenacomys intermedius mackenzii Preble

Lemming Mouse

Phenacomys mackenzii Preble, Proc. Biol. Soc. Washington, 15:182, August 6, 1902. (Type from Fort Smith, Slave River, Mackenzie, Canada.)

Phenacomys intermedius mackenzii Crowe, Bull. Amer. Mus. Nat. Hist., 80:403, February 4, 1943.

Specimen examined.—One from *Yukon Territory:* SE end Dezadeash Lake.

Remarks.—A subadult taken only a few miles from the Alaskan border in Yukon Territory constitutes an extension of the known range of this species to the northwest. The mouse is evidently rare or irregular in its distribution since Alcorn did considerable trapping in the area from which only one was taken.

Microtus pennsylvanicus

Pennsylvania Meadow Mouse

The Pennsylvania meadow mouse is an abundant mammal along the Alaska Highway. Alcorn obtained specimens at most of his trapping stations, frequently in company with *Microtus oeconomus* at the more northern localities. A preferred habitat was grassy areas and willow clumps along streams or at the edges of lakes. The best catches were made along well-used runways, especially where there were piles of cut grass. These runways were used also by *Clethrionomys* and other small animals. Specimens of *M. pennsylvanicus* were frequently taken in the daytime; one was taken on June 29 as it was swimming at the edge of a small lake near the junction of the Liard River and Irons Creek in British Columbia.

Lacking sufficient comparative material in the past, most workers have considered that *M. pennsylvanicus* ranges without appreciable geographic variation throughout most of northwestern Canada and Alaska, where it has been referred to the subspecies, *M. p. drummondii*. Dale (1940), in studying collections made in British Columbia and southeastern Alaska, found evidence of geographic variation and recognized two new subspecies; thus he not only pointed out geographically variable characters but reduced the size of the range ascribed to *M. p. drummondii*. A later work by Rand (1943) considered the northwestern populations of *M. pennsylvanicus* as being too variable to show distinctive groupings. The large collection made by Alcorn offers evidence that other separable subspecies with constant characters are present. Study of this material indicates the presence of two unnamed subspecies, which are named and described as follows:

Microtus pennsylvanicus alcorni new subspecies

Type.—Female, adult, skin with skull, No. 21552, Univ. Kansas, Mus. Nat. Hist., 6 mi. SW Kluane, 2550 feet elevation, Yukon Territory, Canada; 24 August 1947; obtained by J. R. Alcorn; original No. 5240.

Range.—Extreme southwestern Yukon Territory and adjacent parts of Alaska as far south as Haines, as far north as Northway, and as far west along the Alaskan coast as Anchorage and Tyonek.

Diagnosis.—Size large (see measurements); color of upper parts near (*l*) Brussels Brown; skull noticeably ridged; zygomatic arches heavy, rounded and relatively short; rostrum heavy; auditory bullae not greatly expanded; maxillary teeth relatively heavy and low-crowned.

Comparisons.—From *M. p. drummondii* (specimens from vicinity of Whitehorse, Y. T., Trutch, B. C., and Kinuso, Alberta), *M. p. alcorni* differs as follows: Averaging larger in all measurements taken except lengths of tail and hind foot, which are the same; color of upper parts slightly paler and more gray and less brown; underparts paler; zygomatic arches heavier, rounder

and shorter; skull proportionately more massive, except the auditory bullae which are less inflated; maxillary teeth heavier and lower-crowned.

From *M. p. rubidus* (specimens from Atlin, B. C.), *M. p. alcorni* differs as follows: Averaging larger in all cranial measurements taken except length of the maxillary tooth-row which is the same; color of upperparts more gray and less brown; underparts darker; skull longer with longer nasals and heavier zygomatic arches; skull of adult more heavily ridged.

From *M. p. admiraltiae* (specimens from Admiralty Island), *M. p. alcorni* differs as follows: Averaging larger in all measurements taken; color of upper parts more gray and less brown, underparts darker.

Remarks.—*Microtus p. alcorni* is a well-defined subspecies differing markedly from adjacent subspecies by a larger and heavier skull and broader, more rounded and heavier zygomatic arches. Characters examined in the specimens available are constant. Specimens from Haines are slightly darker than those from Kluane. An adult (No. 21534, UKMNH) from Northway has slightly more inflated auditory bullae than those from Kluane. An adult from Tyonek (No. 986, UKMNH) has richer brown upper parts. Measurements of this specimen resemble closely those of animals from Kluane, although the rostrum is noticably heavier.

Several adults were available from many of the localities of occurrence of *M. p. alcorni*. At the locality 9 miles west and 4 miles north of Haines, there were four which were considered to be old adults. These four had larger measurements than others considered to be fully adult. In addition, the skulls were larger and more rugged. There were occasionally old adults in other series. For the sake of uniformity, I have not considered these aforementioned old adults in the comparative studies of younger adults. This subspecies is named in honor of J(oseph). R(aymond). Alcorn, the collector.

Measurements.—Average and extreme measurements of six adults of both sexes of *M. p. alcorni* from the type locality are as follows: Total length, 162 (149-172); length of tail, 43 (39-45); condylobasal length, 26.3 (25.6-26.3); basal length, 25.2 (24.2-25.9); length of nasals, 7.3 (6.9-7.5); zygomatic breadth, 15.3 (14.9-15.6); breadth across auditory bullae, 12.8 (12.4-13.2); alveolar length of upper molariform tooth-row, 6.4 (6.1-6.7). Seven adults of both sexes from 9 miles west and 4 miles north of Haines have the following measurements: 158 (148-165); 45 (41-50); 26.1 (25.5-26.8); 24.8 (24.4-25.7); 7.3 (7.0-7.6); 14.9 (14.3-15.1); 12.2 (11.8-13.0); 6.2 (5.9-6.3).

Specimens examined.—Total 65, distributed by localities of capture as follows and deposited in the University of Kansas Museum of Natural History: *Alaska:* E side Deadman Lake, 1800 ft., 15 mi. SE Northway, 7; 1 mi. NE Anchorage, 100 ft., 1; Tyonek, Cook's Inlet, 1; E side Chilkat River, 100 ft., 9 mi. W and 4 mi. N Haines, 37. *Yukon Territory:* 6 mi. SW Kluane, 2250 ft., 14; SW end Dezadeash Lake, 2; 1½ mi. S and 3 mi. E Dalton Post, 2500 ft., 3. Specimens reported by Osgood (1904:35) have not been seen by me but may be of this subspecies, and are tentatively referred to it. These are from the following localities in Alaska: Lake Clark near Keejik, near the mouth of the Chulitna River, and Kakhtul River near the junction with the Malchatna.

Microtus pennsylvanicus tananaensis new subspecies

Type.—Female, adult, skin with skull, No. 21509, Univ. Kansas, Mus. Nat. Hist., Yerrick Creek, 21 mi. W and 4 mi. N Tok Junction, Alaska; 20 July 1947; obtained by J. R. Alcorn; original No. 5023.

Range.—East-central Alaska as far south as Tok Junction, as far west as Mt. McKinley, as far north as Fairbanks and as far east as Eagle.

Diagnosis.—Size medium (see measurements); color of upper parts dark, near (*n*) Prout's Brown, with some individual variation; skull with zygomatic arches moderately heavy and wide; nasals relatively long; auditory bullae inflated.

Comparisons.—From *M. p. alcorni* (see description), *M. p. tananaensis* differs as follows: Smaller in all measurements taken except alveolar length of upper molariform tooth-row which is the same; color of upper parts darker, more richly brown and less gray; underparts darker; zygomatic arches less massive and narrower; auditory bullae larger and more inflated.

From *M. p. drummondii* (see comparisons under *M. p. alcorni*), *M. p. tananaensis* differs as follows: Larger in all cranial measurements taken except nasal length which is the same; color everywhere slightly darker; wider across zygomatic arches; zygoma thicker; nasals, relative to length of skull, shorter; auditory bullae larger and more inflated.

Remarks.—For the most part the material available of this subspecies consisted of subadults; however, comparison of adults with those of adjacent subspecies indicates that this subspecies can be distinguished by color of the upper parts, cranial measurements, and size of the zygomatic arches and the auditory bullae. Specimens from 14 miles east and 25 miles north of Fairbanks are especially dark. One subadult (No. 21467, UKMNH) has blackish hair on the feet and a blackish unicolored tail. No. 241696, USBS, an old adult female, from Ketchumstock, is larger.

The specimens referred to this subspecies, vary some in color, but vary less in cranial characters. Additional adults are needed from western Alaska to determine how far this subspecies extends down the valley of the Yukon River. Bailey (1900:24) lists one specimen from Nulato, as *drummondii;* I have not seen it but on geographic grounds tentatively assign it to *M. p. tananaensis.*

Measurements.—Measurements of the type specimen are as follows: Total length, 160; length of tail, 40; condylobasal length, 26.0; basal length, 24.9; length of nasals, 6.7; zygomatic breadth, 14.5; breadth across auditory bullae, 12.5; alveolar length of upper molariform tooth-row, 6.2. Two specimens from Eagle (Nos. 128295 and 128320, USBS) have the following measurements respectively: 161, 154; 37.5, 36; 25.3, 25.4; 23.8, 23.9; 6.5, 6.8; 14.5, 14.6; 11.9, 12.3; 6.1, 6.1.

Specimens examined.—Total 34, distributed by localities of capture as follows and unless otherwise stated in the University of Kansas Museum of Natural History: *Alaska:* Near Buster Creek, Chatanika River, 1 (USBS); Chatanika River, 700 ft., 14 mi. E and 25 mi. N Fairbanks, 4; Fairbanks, 2 (USBS); head of Glacier Creek, Mt. McKinley, 1 (USBS); Moose Creek, Mt. McKinley, 2 (USBS); head of Toklat River, 1 (USBS); Eagle, 4 (USBS); Yerrick Creek, 21 mi. W and 4 mi. N Tok Junction, 13; Ketchumstock, 2 (USBS); 9 mi. from mouth of Robertson River, 1 (USBS); Tanana, 3

(USBS); Tanana Crossing, 1 (USBS). Osgood (1909b:24) records specimens which may be of this subspecies from the following localities in Alaska: Charlie Creek, Circle, 20 miles above Circle, 40 miles above Circle, Nation Creek, and Seventy Mile Creek. Osgood (1900:36) also records specimens from near Fort Yukon. None of these has been seen by me; they are only tentatively assigned to this subspecies.

Microtus pennsylvanicus drummondii (Audubon and Bachman)

Arvicola drummondii Audubon and Bachman, Quadr. North Amer., 3:166, 1854. (Type, by subsequent designation, from vicinity of Jasper House, Alberta.)

Microtus pennsylvanicus drummondii Hollister, Canadian Alp. Jour., Special Number, p. 23, February 17, 1913.

Specimens examined.—Total 93, as follows: *Yukon Territory:* McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 26; W side Lewes River, 2150 ft., 2 mi. S Whitehorse, 4; 5 mi. W Teslin River, 2400 ft., 16 mi. S and 53 mi. E Whitehorse, 7; E side Teslin River, 2300 ft., 16 mi. S and 59 mi. E Whitehorse, 1. *British Columbia:* 1 mi. NW jct. Irons Creek and Liard River, 8; Hot Springs, 3 mi. WNW jct. Trout River and Liard River, 3; N side Liard River, ½ mi. W jct. Liard River and Trout River, 1; ¼ mi. S jct. Trout River and Liard River, 13; S side Toad River, 10 mi. S and 21 mi. E Muncho Lake, 2; Summit Pass, 4200 ft., 10 mi. S and 70 mi. W Fort Nelson, 2; E side Minaker River, 1 mi. W Trutch, 19; Beatton River, 115 mi. S Fort Nelson, 1; 5 mi. W and 3 mi. N Fort St. John, 2. *Alberta:* Assineau River, 1920 ft., 10 mi. E and 1 mi. N Kinuso, 4.

Remarks.—Adults among the specimens listed above vary but little; one female from Assineau River in Alberta is notably more reddish than others taken elsewhere.

Average and extreme measurements of nine adults of both sexes of *M. p. drummondii* from E side Minaker River, 1 mi. W Trutch, British Columbia, are as follows: Total length, 157 (148-165); length of tail, 42 (37-46); condylobasal length, 25.1 (24.7-26.0); basal length, 24.2 (23.4-25.0); length of nasals, 6.8 (6.4-7.2); zygomatic breadth, 14.4 (13.9-14.7); breadth across auditory bullae, 12.4 (12.0-12.7); alveolar length of upper molariform tooth-row, 6.1 (6.0-6.2); Nine adults of both sexes from McIntyre Creek, 2250 ft., 3 miles northwest of Whitehorse, Yukon Territory, have the following measurements: 153 (147-168); 40 (33-47); 24.9 (24.2-25.5); 24.0 (23.6-24.6); 6.6 (6.2-7.2); 14.4 (13.9-15.1); 12.1 (11.7-12.5); 6.1 (6.0-6.2).

Microtus *cf.* cantator Anderson

Yukon Singing Mouse

Microtus cantator Anderson, Nat. Mus. Canada, Bull. No. 102, Biol. Ser. No. 31:161, [for 1946], January 24, 1947. (Type "taken in tundra-slide above timber-line on mountain top near Tepee Lake on north slope of St. Elias Range," Yukon Territory, Canada.)

Specimen examined.—One from *Alaska:* Fish Creek, 3400 ft., 5 mi. N and 1 mi. E Paxson.

Remarks.—The single adult male, obtained by Alcorn, has been compared by Dr. Henry W. Setzer with specimens of *Microtus muriei* Nelson, *M. miurus miurus* Osgood, and *M. m. oreas* Osgood

in the United States National Museum. He reports that the specimen is related most closely to *M. miurus* but exhibits characters by which it is, at least, subspecifically distinct from these two forms of this species. Three specimens of *M. andersoni* Rand and one of *M. cantator* Anderson, borrowed from the National Museum of Canada are less mature than the specimen in question. Even so, the male from Fish Creek is less gray than *M. andersoni* and as seen from measurements of the type, an adult male (Rand, 1945:42), is larger with longer tail and has a shorter and narrower skull and is judged to be taxonomically separable. *M. cantator* was named from two specimens; both the paratype (seen by me) and seemingly the type are too young to show clearly subspecific characters. Alcorn's specimen is tentatively referred to *M. cantator* until some adult topotypes can be obtained. Measurements of the male, No. 21539, from Fish Creek, are: Total length, 152; length of tail, 30; hind foot, 22; condylobasal length, 28.0; basal length, 26.6; length of nasals, 7.1; zygomatic breadth, 13.8; breadth across auditory bullae, 11.5; least interorbital breadth, 3.3; alveolar length of upper molariform tooth-row, 6.2.

Alcorn took this specimen in an area above timberline where a low growth of willow was the dominant vegetation. Traps were set where he had seen a mouse go into a small burrow. The next morning, August 18, 1947, he found this specimen and two *Microtus oeconomus macfarlani* in his traps.

Microtines of the subgenus *Stenocranius* from continental areas of Alaska and Northwestern Canada are represented in collections by a few specimens from widely separated localities. Lacking material from intermediate localities, describers have given specific recognition to several of these isolated populations. Future collecting will be necessary to disclose whether the North American mice of this subgenus belong to one or to more than one species and may disclose whether or not there has been more than one invasion of the North American continent by members of this Asiatic group.

Microtus longicaudus vellerosus J. A. Allen

Long-tailed Meadow Mouse

Microtus vellerosus J. A. Allen, Bull. Amer. Mus. Nat. Hist., 12:7, March 4, 1899. (Type from upper Liard River, British Columbia, Canada.)

Microtus longicaudus vellerosus Anderson and Rand, Canadian Field-Nat., 58:20, April 1, 1944.

Specimens examined.—Total 127, as follows: *Alaska:* N side Salcha River, 600 ft., 25 mi. S and 20 mi. E Fairbanks, 1. *Yukon Territory:* 6 mi. SW Kluane, 2550 ft., 2; McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 10; ½

mi. W Whitehorse, 1; SW end Dezadeash Lake, 18; 1½ mi. S and 3 mi. E Dalton Post, 2500 ft., 24. *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 20; Hot Springs, 3 mi. WNW jct. Trout River and Liard River, 4; ¼ mi. S jct. Trout River and Liard River, 15; S side Toad River, 10 mi. S and 21 mi. E Muncho Lake, 27; SE end Muncho Lake, 4; Summit Pass, 4500 ft., 10 mi. S and 70 mi. W Fort Nelson, 1.

Remarks.—Specimens from 1½ miles south and 3 miles east of Dalton Post and from Dezadeash Lake in Yukon Territory and from Stonehouse Creek in British Columbia are referred to *M. l. vellerosus* although in color of upper parts they show close relationship with *M. l. littoralis.* These specimens are less gray and more brown than specimens more typical of *M. l. vellerosus* from the Liard River area.

Alcorn found the long-tailed meadow mouse in widely separated areas. Most specimens were obtained in grassy situations near water or on moist ground. The single male from Summit Pass in British Columbia was taken above timberline.

Microtus longicaudus littoralis Swarth

Long-tailed Meadow Mouse

Microtus mordax littoralis Swarth, Proc. Biol. Soc. Washington, 46:209, October 26, 1933. (Type from Shakan, Prince of Wales Island, Alaska.)

Microtus longicaudus littoralis Goldman, Jour. Mamm., 19:491, November 14, 1938.

Specimens examined.—Total 29, as follows: *Alaska:* E side Chilkat River, 100 ft., 9 mi. W and 4 mi. N Haines, 9; 1 mi. S Haines, 5 ft., 20.

Remarks.—In comparison with the series of *M. l. vellerosus* from the Liard River area, the long-tailed meadow mice from near Haines are more reddish brown, have a longer tail, and have a smaller skull with smaller auditory bullae. This subspecies is restricted to the coastal area, and as noted under the account of *M. l. vellerosus,* intergradation between these two forms occurs a relatively short distance inland.

Microtus oeconomus macfarlani Merriam

Tundra Mouse

Microtus macfarlani Merriam, Proc. Washington Acad. Sci., 2:24, March 14, 1900. (Type from Fort Anderson, Anderson River, Mackenzie district, Northwest Territories, Canada.)

Microtus oec[*onomus*] *macfarlani* Zimmerman, Archiv f. Naturgesch., 11:187, September 12, 1942.

Specimens examined.—Total 70, as follows: *Alaska:* Circle, 664 ft., 1; Chatanika River, 700 ft., 14 mi. E and 25 mi. N Fairbanks, 13; Twelve Mile Summit, 3225 ft., Steese Highway, 6; 1 mi. SW Fairbanks, 440 ft., 3; N side Salcha River, 600 ft., 25 mi. S and 20 mi. E Fairbanks, 28; Yerrick Creek, 21 mi. W and 4 mi. N Tok Junction, 9; Fish Creek, 3400 ft., 5 mi. N and 1 mi. E Paxson, 3; Glenn Highway, 6 mi. WSW Snowshoe Lake, 1. *Yukon Territory:* Jct. Grafe and Edith Creeks, 1; 6 mi. SW Kluane, 2550 ft., 2; SW end

Dezadeash Lake, 1. *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 2.

Remarks.—Alcorn found the tundra mouse in many of the localities at which he trapped in east-central Alaska. Specimens were taken above timberline, along roads, in grassy areas which had been cleared of timber, and in low vegetation bordering streams. On August 17 at Fish Creek, 5 miles north and 1 mile east of Paxson, Alaska, Alcorn obtained one of these mice in a tree in the daytime. Immature specimens taken at Stonehouse Creek are, to my knowledge, the first records for this species in British Columbia.

Mus musculus Linnaeus

House Mouse

[*Mus*] *musculus* Linnaeus, Syst. Nat., ed. 10, 1:62, 1758. (Type from Upsala, Sweden.)

Specimens examined.—Total 6, as follows: *Alaska:* 1 mi. NE Anchorage, 100 ft., 2. *Yukon Territory:* McIntyre Creek, 2259 ft., 3 mi. NW Whitehorse, 2; 2 mi. NNW Whitehorse, 2100 ft., 1. *Alberta:* Assineau River, 1920 ft., 10 mi. E and 1 mi. N Kinuso, 1.

Remarks.—Alcorn took house mice in and near areas inhabited by man. One mouse was taken near Whitehorse on July 10 under a building which had not been occupied for one year. Another was taken at the Whitehorse city dump. Near Kinuso, one specimen was obtained at the site of an old sawmill.

Zapus hudsonius hudsonius (Zimmermann)

Meadow Jumping Mouse

Dipus hudsonius Zimmermann, Geogr. Gesch., 2: 358, 1780. (Type from Hudson Bay, Canada.)
Zapus hudsonius Coues, Bull. U. S. Geol. and Geogr. Surv. Terr., ser. 2, 1:253, January 8, 1876.

Specimens examined.—Total 8, as follows: *British Columbia:* 1 mi. NW jct. Irons Creek and Liard River, 3; Hot Springs, 3 mi. WNW jct. Trout River and Liard River, 1; E side Minaker River, 1 mi. W Trutch, 1; 5 mi. W and 3 mi. N Fort St. John, 1. *Alberta:* Assineau River, 1920 ft., 10 mi. E and 1 mi. N Kinuso, 1.

Remarks.—The jumping mice listed above have been compared with specimens of *Z. h. hudsonius* from Ontario and Michigan. The zone of contact between *Z. h. hudsonius* and *Z. h. alascensis* is still unknown; Alcorn obtained no specimens between Irons Creek and Whitehorse. To my knowledge there are no records from this extensive area.

Alcorn took *Zapus* in grassy areas at the edge of water, in an old gravel pit, and at the site of an old sawmill. Animals were taken as early as June 30 and as late as September 2.

Zapus hudsonius alascensis Merriam

Meadow Jumping Mouse

Zapus hudsonius alascensis Merriam, Proc. Biol. Soc. Washington, 11:223, July 15, 1897. (Type from Yakutat Bay, Alaska.)

Specimens examined.—Total 18, as follows: *Alaska:* 1 mi. SW Fairbanks, 440 ft., 1; E side Chilkat River, 100 ft., 9 mi. W and 4 mi. N Haines, 8. *Yukon Territory:* McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, 4; SW end Dezadeash Lake, 1. *British Columbia:* Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River, 4.

Remarks.—Specimens taken by Alcorn were compared with representatives of both *Z. princeps* (Wyoming, Idaho, Oregon) and *Z. hudsonius* (Ontario, Michigan, Kansas, Wyoming). All have been referred to *Z. hudsonius* although one female from Stonehouse Creek shows some tendency toward *Z. princeps* in external measurements, length of upper molariform tooth-row, and length of incisive foramina.

Erethizon dorsatum myops Merriam

Porcupine

Erethizon epixanthus myops Merriam, Proc. Washington Acad. Sci., 2:27, March 14, 1900. (Type from Portage Bay, Alaska Peninsula, Alaska.)

Erethizon dorsatum myops Anderson and Rand, Canadian Jour. Res., 21:293, September 24, 1943.

Specimens examined.—Total 2, as follows: *Alaska:* Yerrick Creek, 21 mi. W and 4 mi. N Tok Junction, 1. *Yukon Territory:* 2 mi. W Teslin River, 2400 ft., 16 mi. S and 56 mi. E Whitehorse, 1.

Remarks.—Alcorn found little evidence of porcupines along the highway. The female from the Teslin River was found under a building. The female from Yerrick Creek was in dense underbrush in a spruce forest and weighed 20 pounds.

Canis latrans incolatus Hall

Coyote

Canis latrans incolatus Hall, Univ. California Publ. Zool., 40:369, November 5, 1934. (Type from Isaacs Lake, 3000 ft., Bowron Lake region, British Columbia, Canada.)

Specimens examined.—Total 2, as follows: *Yukon Territory:* 25 mi. NW Whitehorse, 1. *British Columbia:* Buckinghorse River, 94 mi. S Fort Nelson, 1.

Canis lupus pambasileus Elliot

Wolf

Canis pambasileus Elliot, Proc. Biol. Soc. Washington, 18:79, February 21, 1905. (Type from Susitna River, region of Mount McKinley, Alaska.)

Canis lupus pambasileus Goldman, Jour. Mamm., 18:45, February 14, 1937.

Specimens examined.—Total 3, as follows: *Yukon Territory:* E side Aishihik River, 17 mi. N Canyon, 1; SW end Dezadeash Lake, 1; Marshall Creek, 3 mi. N Dezadeash River, 1.

Remarks.—Alcorn reported wolf sign at many of his camps along the highway. Skulls were obtained from trappers.

Canis lupus occidentalis Richardson

Wolf

Canis lupus occidentalis Richardson, Fauna Boreali-Americana, 1:60, 1829. (Type not designated, restricted to Fort Simpson, Mackenzie, Canada, by Miller, Smithson. Misc. Coll., 59 (no. 15):4, June 8, 1912.)

Specimens examined.—Two from *British Columbia:* Buckinghorse River, 94 mi. S Fort Nelson.

Canis lupus columbianus Goldman

Wolf

Canis lupus columbianus Goldman, Proc. Biol. Soc. Washington, 54:110, September 30, 1941. (Type from Wistaria, north side of Ootsa Lake, Coast District, British Columbia, Canada.)

Specimens examined.—One from *British Columbia:* Screw Creek, 10 mi. S and 50 mi. E Teslin.

Vulpes fulva abietorum Merriam

Red Fox

Vulpes alascensis abietorum Merriam, Proc. Washington Acad. Sci., 2:669, December 28, 1900. (Type from Stuart Lake, British Columbia, Canada.)

Vulpes fulva abietorum Bailey, Nature Mag., 28:317, November 1936.

Specimens examined.—Total 11, as follows: *Yukon Territory:* 6 mi. SW Kluane, 2559 ft., 1; Marshall Creek, 3 mi. N Dezadeash River, 6; Champagne, N side Dezadeash River, 3; 1½ mi. E Tatshenshini River, 1½ mi. S and 3 mi. E Dalton Post, 1.

Remarks.—Specimens obtained are skulls only, mostly taken in the winter months by trappers. One fox was found dead with procupine quills stuck in and around its mouth.

Ursus americanus cinnamomum Audubon and Bachman

Black Bear

Ursus americanus var. *cinnamomum* Audubon and Bachman, Quadr. North Amer., 3:125, 1854. (Type from Northern Rocky Mountains.)

Specimens examined.—Total 3, as follows: *British Columbia:* 10 mi. W Fort Nelson, 1; Buckinghorse River, 94 mi. S Fort Nelson, 2.

Remarks.—One large, unsexed skull from Buckinghorse River with part of the rostrum gone has the frontal shield strongly dished. A young adult female taken 10 miles west of Fort Nelson on August 23, 1948, has the following external measurements: Total length, 1345; tail, 65; hind foot, 256; ear from notch, 135.

Ursus species

Grizzly

Specimens examined.—Total 5, as follows: *Yukon Territory:* E side Aishihik River, 17 mi. N Canyon, 1; Unahini River, 5 mi. N and 1 mi. E Dalton Post, 1; Unahini River, 3 mi. N and 1 mi. E Dalton Post, 2. *British Columbia:* Buckinghorse River, 94 mi. S Fort Nelson, 1.

Remarks.—Of three specimens obtained at the Unahini River, two males resemble each other closely, while the third, an old adult represented by an unsexed skull with broken cranium, is markedly different, the skull being noticeably shorter with shorter rostrum and lower jaw and other distinctive features. It closely resembles the skull of an adult male taken at the Aishihik River. Furthermore, the first two animals show close relationships with an unsexed skull which Alcorn obtained at the Buckinghorse River in British Columbia.

Two males taken at the Unahini River in the Yukon Territory have the following external measurements: Total length, 1933, 1812; tail, 150, 96; hind foot, 262, 260; ear from notch, 129, 131. Other specimens, skulls only, obtained from native hunters, are partly broken. Alcorn writes that the local hunters always shoot a grizzly in the head to be certain that it is dead.

Mustela erminea arctica (Merriam)

Ermine

Putorius arcticus Merriam, N. Amer. Fauna, 11:15, June 30, 1896. (Type from Point Barrow, Alaska.)

Mustela erminea arctica Ognev, The mammals of U. S. S. R. and adjacent countries, 3:31, 1935.

Specimens examined.—Four from *Alaska:* N side Salcha River, 600 ft., 25 mi. S and 20 mi. E Fairbanks.

Remarks.—One ermine was caught in a rat trap; the others were taken within 50 yards of the trapped animal by attracting them with squeaking calls to within shooting range. One of the weasels approached to within ten feet of Alcorn, while he was making the mentioned call.

Mustela erminea richardsonii Bonaparte

Ermine

Mustela richardsonii Bonaparte, Charlesworth's Mag. Nat. Hist., 2:38, January, 1838. (Type from Fort Franklin, at western end of Great Bear Lake, Mackenzie district, Northwest Territories, Canada.)

Mustela erminea richardsonii Hall, Jour. Mamm., 26:180, July 19, 1945.

Specimens examined.—One from *Yukon Territory:* McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse.

Mustela erminea alascensis (Merriam)

Ermine

Putorius richardsonii alascensis Merriam, N. Amer. Fauna, 11:12, June 30, 1896. (Type from Juneau, Alaska.)
Mustela erminea alascensis Hall, Jour. Mamm., 26:180, July 19, 1945.

Specimens examined.—One from *Alaska:* E side Chilkat River, 100 ft., 9 mi. W and 4 mi. N Haines.

Mustela vison energumenos (Bangs)

Mink

Putorius vison energumenos Bangs, Proc. Boston Soc. Nat. Hist., 27:5, March, 1896. (Type from Sumas, British Columbia, Canada.)
Mustela vison energumenos Miller, North Amer. Land Mamm. 1911, p. 101, December 31, 1912.

Specimen examined.—One (broken and unsexed skull) from *Yukon Territory:* Champagne, N side Dezadeash River.

Remarks.—While studying moose at Medicine Lake, near Circle Hot Springs, Alaska, on August 9, 1947, Alcorn observed some mink concerning which he records the following: "After waiting about an hour a large mink was seen traveling northward on land at the edge of the lake. It continued and went out of sight. I waited about two minutes and then started a series of loud squeaks. To our surprise we soon saw what we judged was the same mink. In company with this mink were five others. . . . These mink were much interested in the squeaking noise and some came within 10 feet of me. They stayed on land most of the time but some of them made short swims a few feet out into the lake. One had a white chin, another had a white spot on its chest. This group may have been an adult female with her young."

Martes pennanti columbiana Goldman

Fisher

Martes pennanti columbiana Goldman, Proc. Biol. Soc. Washington, 48:176, November 15, 1935. (Type from Stuart Lake, near headwaters of Fraser River, British Columbia, Canada.)

Specimens examined.—Total 2, as follows: *British Columbia:* 14 mi. N Fort Halkett, W side Smith River, 1; N side Liard River, Fort Halkett, 1.

Martes americana actuosa (Osgood)

Marten

Mustela americana actuosa Osgood, N. Amer. Fauna, 19:43, October 6, 1900. (Type from Fort Yukon, Alaska.)
Martes americana actuosa Miller, N. Amer. Land Mamm. 1911, p. 93, December 31, 1912.

Specimen examined.—One from *British Columbia:* N side Liard River, Fort Halkett, 1.

Lynx canadensis canadensis Kerr

Canada Lynx

Lynx canadensis Kerr, Anim. Kingd., vol. 1, systematic catalogue inserted between pages 32 and 33 (description, p. 157), 1792. (Type from Eastern Canada.)

Specimens examined.—Total 4, as follows: *Yukon Territory:* Marshall Creek, 3 mi. N Dezadeash River, 1. *British Columbia:* 14 mi. N Fort Halkett, W side Smith River, 2; Buckinghorse River, 94 mi. S Fort Nelson, 1.

Alces americana gigas Miller

Moose

Alces gigas Miller, Proc. Biol. Soc. Washington, 13:57, May 29, 1899. (Type from North side Tustumena Lake, Kenai Peninsula, Alaska.)
Alces americanus gigas Osgood, N. Amer. Fauna, 24:29, November 23, 1904.

Specimens examined.—One from *British Columbia:* 15 mi. NW Kelsall Lake.

Oreamnos americanus columbiae Hollister

Mountain Goat

Oreamnos montanus columbianus J. A. Allen, Bull. Amer. Mus. Nat. Hist., 20:20, February 10, 1904. Not *Capra columbiana* Desmilins, 1823.
Oreamnos americanus columbiae Hollister, Proc. Biol. Soc. Washington, 25:186, December 24, 1912. (Type from Shesley Mountains, northern British Columbia, Canada.)

Specimens examined.—Two from *British Columbia:* 12 mi. S jct. Liard River and Trout River.

Remarks.—Two skulls of male goats were obtained from a trapper, Johnny Pie, who shot them on July 4, 1948. Field notes indicate that both mountain goats and mountain sheep are frequently taken by natives in the Liard River area.

Ovis dalli stonei Allen

Northern Mountain Sheep

Ovis stonei Allen, Bull. Amer. Mus. Nat. Hist., 9:111, April 8, 1897. (Type from headwaters of the Stikine River, British Columbia, Canada.)
Ovis dalli stonei Allen, Bull. Amer. Mus. Nat. Hist., 31:28, March 4, 1912.

Specimen examined.—One from *British Columbia:* Summit Pass, 4200 ft., 10 mi. S and 70 mi. W Fort Nelson.

Remarks.—The specimen has the following external measurements: Total length, 1474; tail, 84; length of hind foot, 400; ear from notch, 91. The individual is a male, seven years old, as judged by the rings of growth on the horns. The skull is accompanied by a skin now tanned for study purposes.

LITERATURE CITED

Anderson, R. M.

1937. Mammals and birds of the Western Arctic District, Northwest Territories, Canada. Reprinted from Canada's Western Northland, Dept. of Interior, Ottawa, pp. 97-122, 5 figs., 1 map, July 9.

1947. Catalogue of Canadian Recent mammals. Nat. Mus. Canada, Bull. 102, Biol. Ser. 31:v + 238 pp., [for 1946], January 24.

Bailey, V.

1900. Revision of American voles of the genus Microtus. N. Amer. Fauna, 17:1-88, 5 pls., 17 figs., June 6.

Cowan, I. M.

1937. The distribution of flying squirrels in western British Columbia with the description of a new race. Proc. Biol. Soc. Washington, 50:77-82, June 22.

Dale, F. H.

1940. Geographic variation in the meadow mouse in British Columbia and southeastern Alaska. Jour. Mamm., 21:332-340, August 14.

Howell, A. H.

1918. Revision of the American flying squirrels. N. Amer. Fauna, 44:1-64, 7 pls., 4 figs., June 13.

1924. Revision of the American pikas. N. Amer. Fauna, 47:1-57, 6 pls., 4 figs., August 21.

Jackson, H. H. T.

1928. A taxonomic review of the American long-tailed shrews. N. Amer. Fauna, 51:i-vi + 1-238, 13 pls., 24 figs., July.

Orr, R. T.

1945. A study of the *Clethrionomys dawsoni* group of red-backed mice. Jour. Mamm., 26:67-74, February 27.

Osgood, W. H.

1900. Results of a biological reconnaissance of the Yukon River region. N. Amer. Fauna, 19:1-100, 7 pls., October 6.

1904. A biological reconnaissance of the base of the Alaska Peninsula. N. Amer. Fauna, 24:1-86, 7 pls., November 23.

1909a. Revision of the mice of the American genus Peromyscus. N. Amer. Fauna, 28:1-285, 8 pls., 12 figs., April 17.

1909b. Biological investigations in Alaska and Yukon Territory. N. Amer. Fauna, 30:1-96, 5 pls., October 7.

Rand, A. L.

1943. Canadian forms of the meadow mouse (*Microtus pennsylvanicus*). Canadian Field-Nat., 57:115-123, January 24.

1944. The southern half of the Alaska highway and its mammals. Nat. Mus. Canada, Bull. No. 98, Biol. Ser. No. 27:1-50, 21 pls., 1 fig.

1945. Mammal investigations on the Canol Road, Yukon and Northwest Territories, 1944. Nat. Mus. Canada, Bull. No. 99, Biol. Ser. No. 28:1-52, 20 pls., 1 fig.

Swarth, H. S.

1936. Mammals of the Atlin region, northwestern British Columbia. Jour. Mamm., 17:398-405, November 14.

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A Synopsis of the North American Lagomorpha

BY

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A Synopsis of the North American Lagomorpha

BY

E. RAYMOND HALL

The most popular small game mammal in nearly every part of North America is one or another of the species of rabbits or hares. The rabbit is one of the few species of wild game that still is hunted commercially and sold for food on the open market. The close association and repeated contact of man with these animals has resulted in his contracting such of their diseases are are transmissible to him. Consequently the rabbits and hares have figured in many investigations concerned with public health and medicine. Because the number of such investigations is increasing, there has been an increasing number of specimens of these animals submitted to mammalogists for identification; also, inquiries are received as to the degree of relationship between two or more of the named kinds of rabbits in which identical, or closely related, disease organisms have been found; other inquiries have to do with the degree of relationship of named kinds of rabbits and hares in widely separated parts of the continent.

The monographs to which the investigator could turn to obtain answers to some of these questions are Arthur H. Howell's "Revision of the American Pikas" (1924), and Edward H. Nelson's "The Rabbits of North America" (1909) published 27 and 42 years ago, respectively. These monographs are still excellent sources of detailed information, as, of course, also is Marcus Ward Lyon's "Classification of the Hares and their Allies" (1904). The acquisition of additional study specimens in recent years, however, has provided new data on the geographic occurrence of several species, and study of these specimens has given basis for a different arrangement of several named kinds of the lagomorphs. Two principal aims of the present synopsis, therefore, are to combine in one publication the current taxonomic arrangement and as much as is known of the geographic distribution of the several species and subspecies.

The maps herewith and listings of marginal localities are the means chosen to present the information on geographic distribution. The artificial key is supplemented by line drawings of skulls of certain species and by a minimum of text to aid the user of the key.

The skulls are necessary for the identification of some species of the genus *Sylvilagus*. The skins, on the contrary, are essential for the identification of the species of the genus *Lepus* in central Mexico and in the Great Basin of the western United States. Consequently, it has been impossible to construct a key based on external characters only or on cranial features only. Furthermore, the only apparent differences between a given pair of species in one region may not be apparent in another region where the same two species occur together. A case in point is provided by *Sylvilagus floridanus* and *Sylvilagus nuttallii* where the Great Plains meet the eastern flank of the Rocky Mountains and where the Sonoran desert meets the southwestern flank of these mountains. The details are described by Hall and Kelson (1951:52, 53) and are indicated in the part of the accompanying artificial key that takes out the species *Sylvilagus nuttallii*. Because of this geographic change in specific characters and because of the slight amount of difference between certain species of leporids, I have frequently resorted to geography, instead of to morphology alone, in constructing the artificial key. Despite this fault of the key to the lagomorphs, it, and the accompanying account, I hope, will aid workers who need to identify kinds of lagomorphs and to know about their geographic distribution.

Another reason for presenting a synopsis of the lagomorphs at this time is that the presentation may bring suggestions for improvement in the arrangement of the kind of information presented here; an account along similar lines for all of the kinds of mammals native to North America is in prospect. Corrections of, and additions to, the material presented here will be welcomed and I shall be especially grateful for suggestions as to a more useful arrangement of the data.

In arranging the families, genera and species the aim has been, in each category, to list the most primitive members first and to list last the one which presents the highest total of specialization. The term *total of specialization* is used here, as Miller (1924:2) used it, to denote the sum of the physical modifications which any mammal, or taxonomic category of mammals, is supposed by the author to have undergone during the course of its development away from its original or generalized mammalian stock.

Subspecies of any one species are arranged alphabetically. On the maps, of course, the subspecies are shown in their correct geographic positions.

For each subspecies, or species if it has not been divided into subspecies, there is given (1) the accepted scientific name (selected

in accordance with the rules of the International Commission of Zoological Nomenclature); (2) a citation to the account in which the terminal part of the name was first proposed (the original description of zoological parlance) followed by a statement of the type locality; (3) a citation to the account in which the combination of names (generic, specific and subspecific) used in the present account first was employed unless the name combination used here is the same as that in the original description; (4) synonyms arranged in chronological order, and (5) marginal record stations of occurrence.

These marginal records are arranged in clockwise order beginning with the northernmost locality. If more than one of the marginal localities lies on the line of latitude that is northernmost for a given kind of mammal, the westernmost of these is recorded first. The marginal localities that are represented by symbols on the corresponding distribution map are in Roman type. Italic type is used for those marginal localities that could not be represented by symbols on the map because undue crowding, or overlapping, of the symbols would have occurred. An understanding of how these localities are arranged and knowledge as to which of these localities are shown on the map will permit a person to associate any symbol on a map with its corresponding place name.

Measurements are in millimeters unless otherwise indicated. Capitalized color terms are after Ridgway (Color Standards and Color Nomenclature, Washington, D. C., 1912), and uncapitalized terms refer to no particular color standard. Several of the drawings of skulls were reproduced originally in the "Mammals of Nevada" (Hall, 1946) and I am grateful to the University of California Press for permission to use them here. Those drawings were made by Miss Viola Memmler. The other drawings are the work of Mrs. Frieda Abernathy, Mrs. Diane (Danley) Sandidge, and Mrs. Virginia (Cassel) Unruh. Initials on the drawings identify the individual's work. The study here reported upon was aided by a contract between the Office of Naval Research, Department of the Navy, and the University of Kansas (NR 161-791). Also, assistance with some of the field work was given by the Kansas University Endowment Association and by Dr. Curt von Wedel. For the corrected dates on several publications I am indebted to Dr. A. Remington Kellogg. For assistance with the organization of the data for the present account I am grateful to several persons, especially to my wife, Mary F. Hall, and to Dr. Keith R. Kelson.

Order LAGOMORPHA—Hares, Rabbits and Pikas

Families and genera revised by Lyon, Smithsonian Miscl. Coll., 45:321-447, June 15, 1904. For taxonomic status of group see Gidley, Science, n. s., 36:285-286, August 30, 1912.

The order Lagomorpha is old in the geological sense; fossilized bones and teeth of both pikas and rabbits are known from deposits of Oligocene age and even at that early time the structural features distinguishing these animals from other orders were well developed.

A noteworthy character of the order is the presence of four upper incisor teeth (instead of only two as in the Rodentia); also, the fibula is ankylosed to the tibia and articulates with the calcaneum. Each of the first upper incisors has a longitudinal groove on its anterior face.

All lagomorphs are herbivorous. They eat principally leaves and non-woody stems although the bark of sprouts and bushes is taken as second choice by rabbits and hares.

Correlation of structure and function is well illustrated among the lagomorphs by the means which the different species employ to detect and escape from their enemies. A gradient series is evident in which the pikas and jack rabbits are the extremes. The black-tailed jack rabbit, for example, in relation to size of the entire animal, has the longest ears and longest hind legs. This kind of lagomorph takes alarm when an enemy, for example, a coyote, is yet a long way off. The jack rabbit seeks safety in running; even when being overtaken by a pursuer that is close behind, the jack rabbit still relies on its running ability instead of entering thick brush or a hole in the ground where its larger-sized pursuer would be unable to follow. A cottontail has shorter ears and shorter hind legs. It allows the enemy to approach more closely than the jack rabbit does before running, and then, although relying in some measure on its running ability for escape, flees to a burrow or thicket for safety from its pursuer. The brush rabbit with ears and hind legs shorter than those of the cottontail seldom if ever ventures farther than 45 feet away from the edge of dense cover. After an enemy is near, the brush rabbit has merely to scamper back into the brush. Still shorter of ear and hind leg is the pigmy rabbit which ventures outside its burrow to feed only among the tall and closely-spaced bushes of sagebrush among which its burrow is dug. Detection of the slightest movement of an enemy on the opposite side of the bush sends the pigmy rabbit, in one or a few jumps, into

the mouth of its burrow and, if need be, below ground. The pika, with the shortest ears and legs of all, lives in the rock slides and has to do little more than drop off the top of a rock into a space between the broken rocks when an enemy is detected near enough to the pika to have a chance of seizing it.

The number of molts in a year, depending on the kind of lagomorph, varies in adults from one (according to Nelson, 1909: 31) in the cottontails (genus *Sylvilagus*) to as many as three (according to Lyman, 1943, and Severaid, 1945) in the varying hare (*Lepus americanus*). Difficulties that I have experienced in attempting to account for the variations in color and wear of the pelage of the pika, *Ochotona princeps,* on the basis of two molts per year, make me wonder if it, too, has three molts. *Lepus townsendii* certainly has at least two molts per year.

KEY TO FAMILIES AND GENERA OF LAGOMORPHA

1. Hind legs scarcely larger than forelegs; hind foot less than 40; nasals widest anteriorly; no supraorbital process on frontal; five cheek teeth on each side above.....Family Ochotonidae, Genus *Ochotona,* p. 125
1′. Hind legs notably larger than forelegs; hind foot more than 40; nasals widest posteriorly; supraorbital process on frontal; six cheek teeth on each side above..... Family Leporidae, p. 134
   2. Interparietal fused with parietals (see fig. 49); hind foot usually more than 105..... Genus *Lepus,* p. 170
   2′. Interparietal not fused with parietals (see fig. 10); hind foot usually less than 105...Genera *Romerolagus* and *Sylvilagus,* pp. 137, 138

Family OCHOTONIDAE—Pikas

Certain characters in which this family differs from the Leporidae (hares and rabbits) are: hind legs scarcely longer than forelegs; ears short, approximately as wide as high; no postorbital process on frontal; rostrum slender; nasals widest anteriorly; maxilla not conspicuously fenestrated; jugal long and projecting far posteriorly to zygomatic arm of squamosal; no pubic symphysis; one less cheek-tooth above, the dental formula being i. $\frac{2}{1}$, c. $\frac{0}{0}$, p. $\frac{3}{2}$, m. $\frac{2}{3}$; second upper maxillary tooth unlike third in form; last lower molar simple (not double) or absent (in the extinct genus *Oreolagus*); cutting edge of first upper incisor V-shaped; mental foramen situated under last lower molar.

Genus OCHOTONA Link—Pikas

Revised by A. H. Howell, N. Amer. Fauna, 47:1-57, August 21, 1924.

1795. *Ochotona* Link, Beyträge zur Naturgesch, 1 (pt. 2):74. Type, *Lepus ogotona* Pallas.

Characters.—Five teeth (excluding incisor) in lower jaw; first cheek-tooth (p3) with more than one re-entrant angle; columns of lower molars angular

internally; transverse width of any one column of a lower molariform tooth more than double the width of the neck connecting it to the other column.

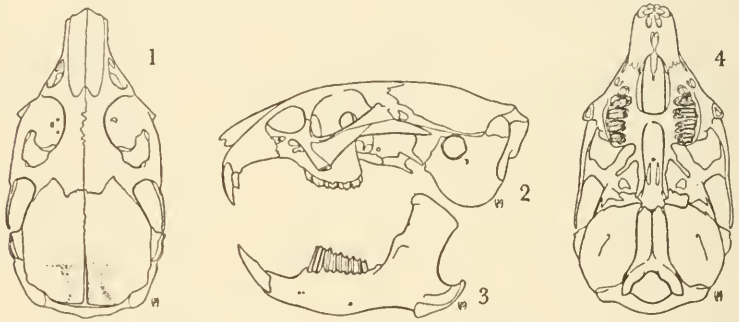
Subgenus PIKA Lacépède

1799. *Pika* Lacépède, Tableau des Divisions &c, Mamm., p. 9. Type, *Lepus alpinus* Pallas.
1904. *Pika,* Lyon, Smiths. Misc. Coll., 45:438, June 15.

Characters.—Skull flattened; interorbital region wide; maxillary orifice roundly triangular; palatal foramina separate from anterior palatine foramina.

All of the living members of the family Ochotonidae belong to this genus. American pikas all belong to the subgenus *Pika,* which occurs also in Eurasia.

The distribution is boreal and the animals live in talus. This broken rock at the foot of a cliff provides interstices in which the animals live and store grass and herbs. These plant materials are cut for food and stacked in piles to dry in the sun, often beneath slabs of rock which protect the hay-piles from rain. Pikas are diurnal, active throughout the year, and have a characteristic call, "chickck-chickck." Young number two to five per litter.



Figs. 1-4. *Ochotona princeps tutelata,* Greenmonster Canyon, 8150 feet, No. 38519 MVZ, ♂, × 1.

Key to Nominal Species of Ochotona

1. North of 58° N latitude; underparts creamy white, without buffy wash; an indistinct grayish "collar" on shoulders ..... *collaris,* p. 126
1′. South of 58° N latitude; underparts washed with buff; no grayish "collar" on shoulders ..... *princeps,* p. 127

Ochotona collaris (Nelson)

Collared Pika

1893. *Lagomys collaris* Nelson, Proc. Biol. Soc. Washington, 8:117, December 21, type from near head of Tanana River, Alaska.
1897. [*Ochotona*] *collaris,* Trouessart, Catalogus Mammalium . . ., p. 648

Marginal records.—Alaska: Mt. McKinley (A. H. Howell, 1924:36). Yukon: head of Coal Creek, Ogilvie Mountains (*ibid.*). Mackenzie: mile 63E

on Little Keel River, Canol Road (Anderson, 1947:94). Yukon: *Macmillan Pass, mile 282, Canol Road* (*ibid.*); Ross River, mile 96, Canol Road (*ibid.*); vic. Teslin Lake (A. H. Howell, 1924:36). British Columbia: Tagish Lake (*ibid.*); Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River (29088 KU). Alaska: Tanana River (A. H. Howell, 1924:36).

Upper parts Drab to Light Drab; underparts creamy white; grayish patch on nape and shoulders; skull broad; tympanic bullae large; total length 189; hind foot, 30.

Ochotona princeps

Pika

Total length, 162-216; hind foot, 25-35; weight of *O. p. tulelata*, 6 ♂ 121 (108-128), 2 ♀ 121 and 129 grams. Upper parts varying from grayish to Cinnamon-Buff depending on the subspecies; underparts with wash of buff. Eight Nevadan females had an average of 3.1 (2-4) embryos. The mode was 3.

OCHOTONA PRINCEPS ALBATA Grinnell.

1912. *Ochotona albatus* Grinnell, Univ. California Publ. Zool., 10:125, January 31, type from 11,000 ft., near Cottonwood Lakes, Sierra Nevada, Inyo County, California.

Marginal records (A. H. Howell, 1924:45).—California: Bullfrog Lake; 10,000 ft., Independence Creek; type locality; Mineral King, E. Fork Kaweah River.

OCHOTONA PRINCEPS BROOKSI A. H. Howell.

1924. *Ochotona princeps brooksi* A. H. Howell, N. Amer. Fauna, 47:30, August 21, type from Sicamous, British Columbia.

Marginal records.—British Columbia: Mountains E Shuswap Lake (Anderson, 1947:95); type locality; McGillivary Creek, Lillooet Dist. (A. H. Howell, 1924:31).

OCHOTONA PRINCEPS BRUNNESCENS A. H. Howell.

1919. *Ochotona fenisex brunnescens* A. H. Howell, Proc. Biol. Soc. Washington, 32:108, May 20, type from Keechelus, Kittitas County, Washington.
1924. *Ochotona princeps brunnescens* A. H. Howell, N. Amer. Fauna, 47: 31, September 23.

Marginal records.—British Columbia: Alta Lake (Anderson, 1947:95); Hope, Lake House (A. H. Howell, 1924:33). Washington: *Whatcom Pass* (Dalquest, 1948:380); Stevens Pass (A. H. Howell, 1924:33); *Cowlitz Pass* (Dalquest, 1948:380). Oregon: Mt. Hood (A. H. Howell, 1924: 33); Crater Lake (*ibid.*); Mt. McLoughlin (V. Bailey, 1936:116); Diamond Lake (A. H. Howell, 1924:33). Washington: Tumtum Mtn. (Dalquest, 1948:380); Mt. Index (A. H. Howell, 1924:33). British Columbia: Chilliwack (*ibid.*); Vancouver (*ibid.*).

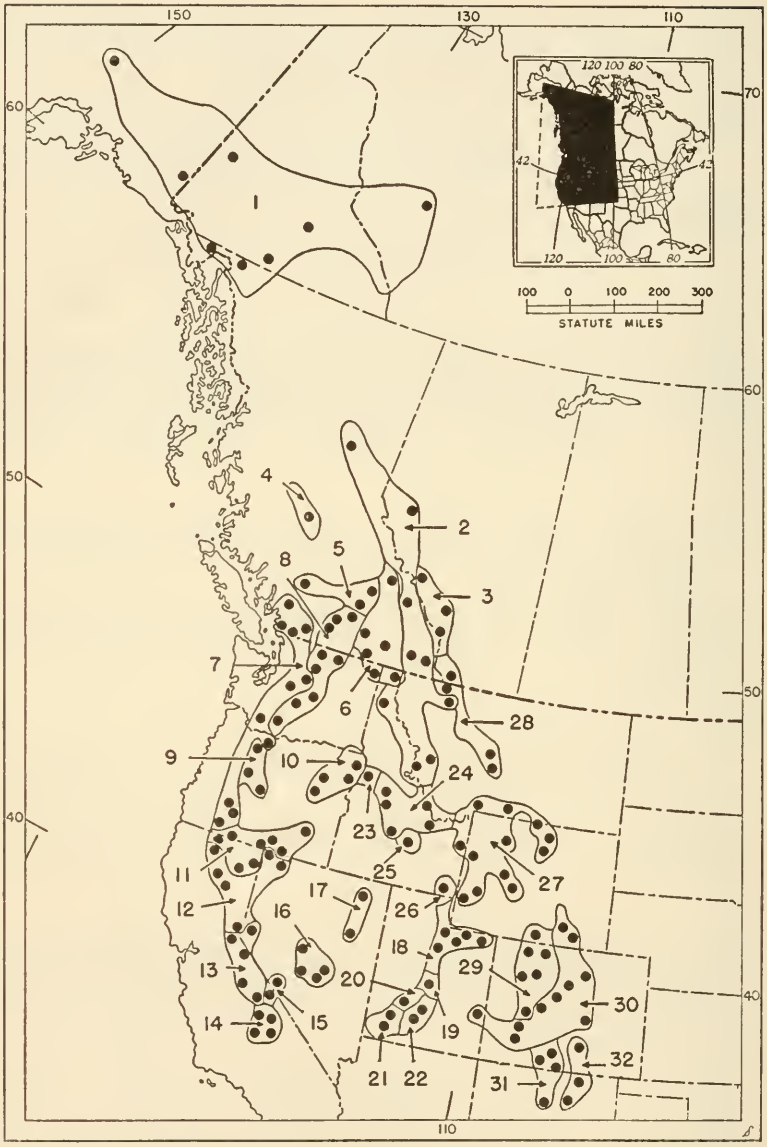


FIG. 5. Distribution of *Ochotona collaris* and *Ochotona princeps*.

1. *O. collaris*
2. *O. p. princeps*
3. *O. p. lutescens*
4. *O. p. septentrionalis*
5. *O. p. brooksi*
6. *O. p. cuppes*
7. *O. p. brunnescens*
8. *O. p. fenisex*
9. *O. p. fumosa*
10. *O. p. jewetti*
11. *O. p. taylori*
12. *O. p. schisticeps*
13. *O. p. muiri*
14. *O. p. albatus*
15. *O. p. sheltoni*
16. *O. p. tutelata*
17. *O. p. nevadensis*
18. *O. p. uinta*
19. *O. p. moorei*
20. *O. p. cinnamomea*
21. *O. p. fuscipes*
22. *O. p. utahensis*
23. *O. p. howelli*
24. *O. p. lemhi*
25. *O. p. goldmani*
26. *O. p. clamosa*
27. *O. p. ventorum*
28. *O. p. levis*
29. *O. p. figginsi*
30. *O. p. saxatilis*
31. *O. p. nigrescens*
32. *O. p. incana*

OCHOTONA PRINCEPS CINNAMOMEA J. A. Allen.

1905. *Ochotona cinnamomea* J. A. Allen, Mus. Brooklyn Inst. Arts and Sci., Sci. Bull., 1:121, March 31, type from 11,000 ft., Briggs [=Britts] Meadows, Beaver Range, Beaver County, Utah (5 mi. by road W Puffer Lake, according to Hardy, Jour. Mamm., 26:432, February 12, 1946). Known from type locality only.

1934. *Ochotona princeps cinnamomea,* Hall, Proc. Biol. Soc. Washington, 47:103, June 18.

OCHOTONA PRINCEPS CLAMOSA Hall and Bowlus.

1938. *Ochotona princeps clamosa* Hall and Bowlus, Univ. California Publ. Zool., 42:335, October 12, type from 8400 ft., north rim Copenhagen Basin, Bear Lake County, Idaho.

Marginal records.—Idaho: type locality; *Deep Lake, Bear River Mts.* (Hall and Bowlus, 1938:336) *2 mi. E Strawberry Creek Ranger Station, Wasatch Mts.* (Davis, 1939:352).

OCHOTONA PRINCEPS CUPPES Bangs.

1899. *Ochotona cuppes* Bangs, Proc. New England Zool. Club, 1:40, June 5, type from 4000 ft., Monashee Divide, Gold Range, British Columbia.

1924. *Ochotona princeps cuppes,* A. H. Howell, N. Amer. Fauna, 47:27, September 23.

Marginal records.—British Columbia: Glacier (A. H. Howell, 1924:28); Nelson (Anderson, 1947:95). Idaho: Cabinet Mts. (Davis, 1939:348). Washington: Sullivan Lake (A. H. Howell, 1924:28). British Columbia: Rossland (*ibid.*); type locality.

OCHOTONA PRINCEPS FENISEX Osgood.

1913. *Ochotona fenisex* Osgood, Proc. Biol. Soc. Washington, 26:80, March 22 (substitute for *minimus* Lord, type from 7000 ft., Ptarmigan Hill, near head of Ashnola River, Cascade Range, British Columbia).

1924. *Ochotona princeps fenisex,* A. H. Howell, N. Amer. Fauna, 47:28, September 23.

1863. *Lagomys minimus* Lord, Proc. Zool. Soc. London, p. 98. (Not of Schinz, 1821.)

1899. *Ochotona minimus,* Bangs, Proc. New England Zool. Club, 1:39, June 5.

Marginal records.—British Columbia: Okanagan (A. H. Howell, 1924:30). Washington: Horseshoe Basin, "near" Mt. Chopaka (*ibid.*); mts. near Wenatchee (*ibid.*); Steamboat Mtn. (Dalquest, 1948:380); Easton (*ibid.*); Lyman Lake (*ibid.*); Barron (A. H. Howell, 1924:30). British Columbia: Tulameen (*ibid.*); 2500 ft., mts. W Okanagan Lake (*ibid.*).

OCHOTONA PRINCEPS FIGGINSI J. A. Allen.

1912. *Ochotona figginsi* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 31:103, May 28, type from Pagoda Peak, Rio Blanco County, Colorado.

1924. *Ochotona princeps figginsi,* A. H. Howell, N. Amer. Fauna, 47:21, September 23.

Marginal records (A. H. Howell, 1924:22).—Wyoming: Bridger Peak, Sierra Madre. Colorado: Mt. Zirkel; Trappers Lake; *Crested Butte;* Irwin; type locality; Sand Mtn., 9 mi. SW Hahns Peak P. O.

OCHOTONA PRINCEPS FUMOSA A. H. Howell.

1919. *Ochotona fenisex fumosa* A. H. Howell, Proc. Biol. Soc. Washington, 32:109, May 20, type from Permilia Lake, W base Mt. Jefferson, Linn County, Oregon.
1924. *Ochotona princeps fumosa* A. H. Howell, N. Amer. Fauna, 47:33, September 23.

Marginal records (A. H. Howell, 1924:34).—Oregon: About 900 ft., 15 mi. above Estacada; Paulina Lake; *Three Sisters;* Lost Creek Ranger Station, 10 mi. SE McKenzie Bridge.

OCHOTONA PRINCEPS FUSCIPES A. H. Howell.

1919. *Ochotona schisticeps fuscipes* A. H. Howell, Proc. Biol. Soc. Washington, 32:110, May 20, type from Brian Head, Parowan Mts., Iron County, Utah.
1941. *O[chotona]. p[rinceps]. fuscipes*, Hall and Hayward, The Great Basin Naturalist, 2:108, July 20.

Marginal records.—Utah: type locality; 9000 ft., Duck Creek (Durrant, MS).

OCHOTONA PRINCEPS GOLDMANI A. H. Howell.

1924. *Ochotona schisticeps goldmani* A. H. Howell, N. Amer. Fauna, 47:40, September 23, type from Echo Crater, Snake River Desert, 20 mi. SW Arco, Idaho.
1938. *Ochotona princeps goldmani*, Hall and Bowlus, Univ. California Publ. Zool., 42:337, October 12.

Marginal records.—Idaho: S *base Grassy Cone* (Davis, 1939:350); type locality; *Fissure Crater* (A. H. Howell, 1924:41); *Great Owl Cavern* (Davis, 1939:350).

OCHOTONA PRINCEPS HOWELLI Borell.

1931. *Ochotona princeps howelli* Borell,, Jour. Mamm., 12:306, August 24, type from 7500 ft., near head of Bear Creek, summit of Smith Mtn., S end Seven Devils Mts., Adams County, Idaho.

Marginal records.—Idaho: *½ mi. E Black Lake* (Davis, 1939:350); type locality.

OCHOTONA PRINCEPS INCANA A. H. Howell.

1919. *Ochotona saxatilis incana* A. H. Howell, Proc. Biol. Soc. Washington, 32:107, May 20, type from 12,000 ft., Pecos Baldy, Santa Fe County, New Mexico.
1924. *Ochotona princeps incana* A. H. Howell, N. Amer. Fauna, 47:25, September 23.

Marginal records.—Colorado: Medano Creek (A. H. Howell, 1924:25,). New Mexico: Wheeler Peak (V. Bailey, 1932:64); type locality.

OCHOTONA PRINCEPS JEWETTI A. H. Howell.

1919. *Ochotona schisticeps jewetti* A. H. Howell, Proc. Biol. Soc. Washington, 32:109, May 20, type from head of Pine Creek, near Cornucopia, S slope Wallowa Mts., Baker County, Oregon.

Marginal records (A. H. Howell, 1924:42).—Oregon: Wallowa Lake; Cornucopia, near head East Pine Creek; *Anthony;* Strawberry Butte; Austin.

OCHOTONA PRINCEPS LEMHI A. H. Howell.

1919. *Ochotona uinta lemhi* A. H. Howell, Proc. Biol. Soc. Washington, 32:106, May 20, type from Lemhi Mountains, 10 mi. W Junction, Lemhi County, Idaho.
1924. *Ochotona princeps lemhi* A. H. Howell, N. Amer. Fauna, 47:16, September 23.

Marginal records.—Idaho: Elk Summit, about 15 mi. SE Warren (A. H. Howell, 1924:18); mts. E of Leadore (*ibid.*); mts. E of Birch Creek (*ibid.*); Ketchum (*ibid.*); *Stanley Lake* (*ibid.*); 5 mi. W Cape Horn (Davis, 1939: 348).

OCHOTONA PRINCEPS LEVIS Hollister.

1912. *Ochotona levis* Hollister, Proc. Biol. Soc. Washington, 25:57, April 13, type from Chief Mountain [= Waterton] Lake, Alberta.
1924. *Ochotona princeps levis*, A. H. Howell, N. Amer. Fauna, 47:16, September 23.

Marginal records (A. H. Howell, 1924:16).—Alberta: type locality. Montana: Little Belt Mts.; Belt Mts.; Chief Mountain Lake.

OCHOTONA PRINCEPS LUTESCENS A. H. Howell.

1919. *Ochotona princeps lutescens* A. H. Howell, Proc. Biol. Soc. Washington, 32:105, May 20, type from approximately 8000 ft., Mount Inglesmaldie, near Banff, Alberta.

Marginal records.—Alberta: Mistaya Creek, Banff-Jasper Highway (Anderson, 1947:96); Canmore (A. H. Howell, 1924:15); Mt. Forget-me-not, 50 to 75 mi. SW Calgary (*ibid.*).

OCHOTONA PRINCEPS MOOREI Gardner.

1950. *Ochotona princeps moorei* Gardner, Jour. Washington Acad. Sci. 40:344, October 23, 1950, type from 10,000 ft., 1 mi. NE Baldy Ranger Station, Manti Nat'l Forest, Sanpete County, Utah. Known from type locality only.

OCHOTONA PRINCEPS MUIRI Grinnell and Storer.

1916. *Ochotona schisticeps muiri* Grinnell and Storer, Univ. California Publ. Zool., 17:6, August 23, type from 9300 ft., Ten Lakes, Yosemite Nat'l Park, California.
1934. *Ochotona princeps muiri*, Hall, Proc. Biol. Soc. Washington, 47:103, June 13.

Marginal records.—Nevada (Hall, 1946:593): 8500 ft., 3 mi. S Mt. Rose. California (A. H. Howell, 1924:44): Markleeville; mts. W Bishop Creek; Washburn Lake; Latitude 39°, summit of Sierra.

OCHOTONA PRINCEPS NEVADENSIS A. H. Howell.

1919. *Ochotona uinta nevadensis* A. H. Howell, Proc. Biol. Soc. Washington, 32:107, May 20, type from 10,500 ft., Ruby Mts., SW Ruby Valley P. O., Elko County, Nevada.
1924. *Ochotona princeps nevadensis* A. H. Howell, N. Amer. Fauna, 47:21, September 23.

Marginal records.—Nevada: 7830 ft., Long Creek (Hall, 1946:590); type locality.

OCHOTONA PRINCEPS NIGRESCENS V. Bailey.

1913. *Ochotona nigrescens* V. Bailey, Proc. Biol. Soc. Washington, 26:133, May 21, type from 10,000 ft., Jemez Mountains, Bernalillo County, New Mexico.
1924. *Ochotona princeps nigrescens*, A. H. Howell, N. Amer. Fauna, 47:26, September 23.

Marginal records (A. H. Howell, 1924:26).—Colorado: Upper Navajo River; Osier. New Mexico: type locality. Colorado: Navajo Peaks.

OCHOTONA PRINCEPS PRINCEPS (Richardson).

1828. *Lepus* (*Lagomys*) *princeps* Richardson, Zool. Jour., 3:520, type from headwaters of Athabaska River, near Athabaska Pass, Alberta.
1897. [*Ochotona*] *princeps*, Trouessart, Catalogus Mammalium . . ., p. 648.

Marginal records.—British Columbia: headwaters South Pine River (Anderson, 1947:95). Alberta: Muskeg Creek "about" 60 mi. N Jasper House (*ibid.*). British Columbia: Morrissey (*ibid.*). Montana: mts. near St. Marys Lake (A. H. Howell, 1924:14); mts. 15 mi. E Corvallis (*ibid.*); Lake Como, Bitterroot Mts. (*ibid.*). Idaho: Cocur d' Alene Nat'l Forest (Rust, 1946:322). British Columbia: Mt. Evans, "near" Cranbrook (A. H. Howell, 1924:14); Spillamacheen River (*ibid.*)

OCHOTONA PRINCEPS SAXATILIS Bangs.

1899. *Ochotona saxatilis* Bangs, Proc. New England Zool. Club, 1:41, June 5, type from Montgomery, "near" Mt. Lincoln, Park County, Colorado.
1924. *Ochotona princeps saxatilis*, A. H. Howell, N. Amer. Fauna, 47:23, September 23.

Marginal records (A. H. Howell, 1924:24, except as otherwise noted).—Wyoming: Medicine Bow Mts.; just above Centennial in mts. (Martin, 1943:394). Colorado: Estes Park; Pikes Peak; Silverton. Utah: LaSal Mts. Colorado: Crystal Lake, 5 mi. W Lake City; Middle Brush Creek; Ten Mile Creek; Berthoud Pass; *Irwin Lakes* (A. H. Howell, *loc. cit.*) not found.

OCHOTONA PRINCEPS SCHISTICEPS (Merriam).

1889. *Lagomys schisticeps* Merriam, N. Amer. Fauna, 2:11, October 30, type from Donner, Placer County, California.
1936. *Ochotona princeps schisticeps*, A. H. Miller, Jour. Mamm., 17:174, May 18.
1897. *Ochotona schisticeps* Merriam, Mazama, 1:223, October.

Marginal records.—Nevada (Hall, 1946:590): 12 mi. E and 3 mi. N Ft. Bidwell, 5700 ft.; 8400-8600 ft., Duffer Peak, Pine Forest Mts. California (A. H. Howell, 1924:39): Tahoe; *Donner Pass;* 12 mi. NE Prattville; Lassen Peak; Mt. Shasta.

OCHOTONA PRINCEPS SEPTENTRIONALIS Cowan and Racey.

1947. *Ochotona princeps septentrionalis* Cowan and Racey, Canadian Field-Nat., 60:102, March 17, type from 6500 ft., Itcha Mountains, 52° 45' N lat., 125° W long., British Columbia. Known from type locality only.

OCHOTONA PRINCEPS SHELTONI Grinnell.

1918. *Ochotona schisticeps sheltoni* Grinnell, Univ. California Publ. Zool., 17:429, April 25, type from 11,000 ft., "near" Big Prospector Meadow, White Mountains, Mono County, California.

1946. *Ochotona princeps sheltoni*, Hall, Mammals of Nevada, p. 593, July 1.

Marginal records.—Nevada: 8700 ft., Pinchot Creek (Hall, 1946:593). California: type locality.

OCHOTONA PRINCEPS TAYLORI Grinnell.

1912. *Ochotona taylori* Grinnell, Proc. Biol. Soc. Washington, 25:129, July 31, type from 9000 ft., Warren Peak, Warner Mts., Modoc Co., Calif.

Marginal records (V. Bailey, 1936:113, unless otherwise noted).—Oregon: N end of Steens Mts.; Guano Valley; Jack Lake, 20 mi. NE Adel; Adel. California (A. H. Howell, 1924:40): type locality; 5400 ft., "near" Termo, Madeline Plains; nr. head Little Shasta Riv. Oregon: Lower Klamath Lake.

OCHOTONA PRINCEPS TUTELATA Hall.

1934. *Ochotona princeps tutelata* Hall, Proc. Biol. Soc. Washington, 47:103, June 13, type from 8150 ft., Greenmonster Canyon, Monitor Mts., Nye County, Nevada.

Marginal records (Hall, 1946:591). — Nevada: 7500 ft., Smiths Creek, Desatoya Mts.; 8600 ft., type locality; 8700-11,000 ft., SW and W slopes Mt. Jefferson, Toquima Range; South Twin River; *Arc Dome.*

OCHOTONA PRINCEPS UINTA Hollister.

1912. *Ochotona uinta* Hollister, Proc. Biol. Soc. Washington, 25:58, April 13, type from "near" head E. Fork Bear River, Uinta Mts., Utah.
1924. *Ochotona princeps uinta*, A. H. Howell, N. Amer. Fauna, 47:19, September 23.

Marginal records.—Utah: type locality; Elk Park (Hall and Bowlus, 1938: 337); *11,000 to 11,500 ft., The Nipple* (*ibid.*); 10,500 ft., SW slope Bald Mtn. (*op. cit.*:336); Mt. Timpanogos (*op. cit.*:337); 8500 ft., Morehouse Canyon, 5 mi. above Weber River (*op. cit.*:337); *Spirit Lake* (*op. cit.*:336) not found.

OCHOTONA PRINCEPS UTAHENSIS Hall and Hayward.

1941. *Ochotona princeps utahensis* Hall and Hayward, Great Basin Nat., 2:107, July 20, type from 2 mi. W Deer Lake, Garfield County, Utah.

Marginal records.—Utah: 9000 ft., Donkey Lake, Boulder Mtn. (Durrant, MS); type locality.

OCHOTONA PRINCEPS VENTORUM A. H. Howell.

1919. *Ochotona uinta ventorum* A. H. Howell, Proc. Biol. Soc. Washington, 32:106, May 20, type from Fremont Peak, Wind River Mts., Fremont County, Wyoming.
1924. *Ochotona princeps ventorum* A. H. Howell, N. Amer. Fauna, 47:18, September 23.

Marginal records.—Montana: Emigrant Peak (A. H. Howell, 1924:19); Beartooth Mts. (*ibid.*). Wyoming: 9600 ft., 19½ mi. E and 4½ mi. S Shell (20882 KU); head of Trappers Creek (A. H. Howell, 1924:19); Medicine Wheel Ranch, 28 mi. E Lovell (32919 KU); Needle Mtn. (A. H. Howell, 1924:19); Lake Fork (*ibid.*); 8450 ft., 17½ mi. S and 6½ mi. W Lander (37994 KU); Middle Piney Lake, "near" Stanley (A. H. Howell, 1924:19); Salt River, 16 mi. S Afton (Hall and Bowlus, 1938:337); Teton Pass (A. H. Howell, 1924:19). Idaho: Teton Canyon (Davis, 1939:349).

Family Leporidae—Rabbits and Hares

Hind legs longer than forelegs; ears longer than wide; frontal bone carrying supraorbital process consisting always of posterior arm and sometimes of anterior arm; rostrum wide; nasals not wider anteriorly than posteriorly; maxillae conspicuously fenestrated; jugal projecting less than half way from zygomatic root of squamosal to external auditory meatus (except in *Romerolagus*); pubic symphysis well marked; dental formula, i. $\frac{2}{1}$, c. $\frac{0}{0}$, p. $\frac{3}{2}$, m. $\frac{3}{3}$ (but m. $\frac{2}{3}$ in *Pentalagus* of Liu Kiu Islands south of Japan); second upper maxillary tooth like third in form; last lower molar double; cutting edge of first upper incisor straight; mental foramen of mandible situated under first lower cheek-tooth. Females average larger than males in all members of this family. (See Orr, 1940:20.) The reverse is true in most other families of mammals.

Hare is a name applied to any lagomorph whose young are born fully haired, with the eyes open, and able to run about a few minutes after birth. The young are born in the open, not in a nest. All of the species of the genus *Lepus* are hares. The species of leporids of all genera other than *Lepus,* in North America at least, are rabbits. Their young are born naked, blind, and helpless, in a nest especially built for them and lined with fur. Considering the degree of development of the young at birth, the gestation periods are about what a person would expect: 26 to 30 days in *Sylvilagus* and 36 to 47 days in *Lepus* (see Severaid, 1950:356-357). Vernacular names are misleading because the names jack rabbit and snowshoe rabbit are applied to hares; also, Belgian hare is a name applied to a rabbit (genus *Oryctolagus*) that is commonly bred in captivity. There are many domestic strains and varieties of *Oryctolagus* and the animals are second only to poultry in some areas as a protein food for man. Also, the pelts are sold as a source of felt and many of the skins are dyed and processed for making fur coats and other fur-pieces that appear on the market under names not readily associated with rabbit.

Rabbits and hares are crepuscular and possibly more nocturnal than diurnal. So far as I know they do not store food as do their diurnal relatives, the pikas. Some leporids, however, have an unusual, and possibly unique, method of processing food: Two types of vegetable pellets are expelled from the anal opening of the digestive tract; the dark brownish pellets, from which the nutri-

ments have been extracted, are feces, but the greenish pellets seem to be only slightly predigested foods which are re-eaten. Southern (1942:553), among others, has written about this. This system functionally resembles that in the ruminants where a cud of vegetation is returned to the mouth, from one part of the stomach, to be re-chewed and finally swallowed.

Because the causative organism of a disease that decimates dense populations of small mammals, and some other kinds of vertebrates, was isolated first in leporids, this disease, tularemia, is more associated in the popular mind with rabbits than with other kinds of mammals. Actually, many kinds of mammals are quite as likely to have tularemia as are rabbits. Now that streptomycin is available, cases of tularemia in persons are easily cured.

KEY TO SPECIES OF THE GENERA SYLVILAGUS AND ROMEROLAGUS

1. Antorbital extension of supraorbital process more than ½ length of posterior extension; first upper cheek-tooth with only one re-entrant angle on anterior face; re-entrant angle of second upper cheek-tooth not crenate ..... *Sylvilagus idahoensis*, p. 139

1'. Antorbital extension of supraorbital process less than ½ of posterior extension or entirely absent; first upper cheek-tooth with more than one (usually 3) re-entrant angles on anterior face; re-entrant angle of second upper cheek-tooth crenate.

2. Anterior extension of supraorbital process absent (or if a point is barely indicated, then 5/6 or all of posterior process fused to braincase).

3. Tympanic bulla smaller than foramen magnum; hind foot more than 74; geographic range wholly in United States.

4. Ear more than 58 from notch in dried skin; basilar length of skull more than 63..... *Sylvilagus aquaticus*, p. 166

4'. Ear less than 58 from notch in dried skin; basilar length of skull less than 63.

5. Underside of tail white; posterior extension of supraorbital process tapering to a slender point, this point free of braincase or barely touching it and leaving a slit or long foramen..... *Sylvilagus transitionalis*, p. 160

5'. Underside of tail brown or gray; posterior extension of supraorbital process always fused to skull, usually for entire length but in occasional specimens there is small foramen at middle of posterior extension of supraorbital process..... *Sylvilagus palustris*, p. 147

3'. Tympanic bulla as large as foramen magnum; hind foot less than 74; geographic range limited to southern edge of Mexican tableland at high elevations..... *Romerolagus diazi*, p. 138

2′. Anterior extension of supraorbital process present, and posterior extension free of braincase or leaving a slit between the process and braincase.

6. Tympanic bullae large (see fig. 26).
Sylvilagus audubonii, p. 162

6′. Tympanic bullae small (see figs. 23, 25 and 27).

7. Restricted to Pacific coastal strip from Columbia River south to tip of Baja California, west of Sierra Nevada-Cascade Mountain Chain; hind foot less than 81.
Sylvilagus bachmani and S. *mansuetus*, pp. 143, 147

7′. East of the Pacific coastal strip mentioned in 7; hind foot usually more than 81.

8. If north of United States-Mexican boundary:

9. In Arizona, New Mexico and southern Colorado posterior extension of supraorbital process free of braincase, and supraoccipital shield posteriorly pointed; from central Colorado north into Canada diameter of external auditory meatus more than crown length of last three cheek-teeth. . . . . *Sylvilagus nuttallii*, p. 161

9′. In Arizona, New Mexico and southeastern Colorado posterior extension of supraorbital process of frontal with its tip against, or fused to, braincase, and supraoccipital shield posteriorly truncate or notched; from central Colorado north into Canada, diameter of external auditory meatus less than crown length of last three cheek-teeth. . . . *Sylvilagus floridanus*, p. 154

8′. If south of United States-Mexican boundary:

10. Geographic range restricted to Tres Marias Islands. . . . . *Sylvilagus graysoni*, p. 169

10′. Geographic range not including Tres Marias Islands.

11. Underside of tail dingy gray or buffy (not white).

12. Tail short (less than 30) and brown like rump; ear from notch (dry) less than 53; interorbital breadth less than 16.
Sylvilagus brasiliensis, p. 141

12′. Tail of moderate length (more than 30) and dingy gray; ear from notch (dry) more than 53; interorbital breadth more than 16. . . . . *Sylvilagus insonus*, p. 168

11′. Underside of tail distinctly white.

(continued)

13. Total length more than 476; ear from notch (dry) more than 64; interorbital breadth usually more than 19.3; geographic range, southwestern Mexico north of the Isthmus of Tehuantepec.
Sylvilagus cunicularius, p. 169

13'. Total length less than 476; ear from notch (dry) less than 64; interorbital breadth usually less than 19.3; geographic range, Canada to Panamá ..... *Sylvilagus floridanus*, p. 154

Genus ROMEROLAGUS Merriam—Volcano Rabbit

1896. *Romerolagus* Merriam, Proc. Biol. Soc. Washington, 10:173, December 29. Type, *Romerolagus nelsoni* Merriam = *Lepus diazi* Diaz.

Total length 300 to 311; tail rudimentary; hind foot, 52; ear from notch (dry), 36; upper parts grizzled buffy brown or dull cinnamon brown; underparts dingy gray; anterior projection of supraorbital process absent; jugal pro-

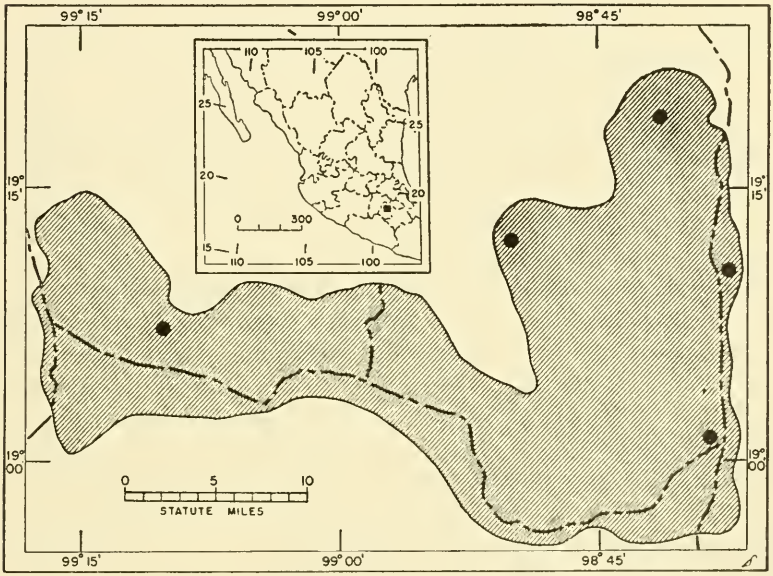


FIG. 6. Distribution of *Romerolagus diazi*.

jecting posteriorly past squamosal root of zygomatic arch more than half way to external auditory meatus. The two cranial characters mentioned are resemblances to pikas although the skull otherwise resembles that of the true rabbits. The genus contains only the one living species.

Living in well defined runways in the dense sacoton grass, these small rabbits are mainly nocturnal and crepuscular, but sometimes are active by day, especially in cloudy weather in the period of mating.

Romerolagus diazi (Diaz)

Volcano Rabbit

1893. *Lepus diazi* Diaz, Catal. Com. Geográf.-Expl. Repub. Mex. Expos. Internac. Columb. Chicago, pl. 42, March, 1893, type from eastern slope of Mount Ixtaccihuatl, Puebla.
1911. *Romerolagus diazi* Miller, Proc. Biol. Soc. Washington, 24:228, October 31, 1911.
1896. *Romerolagus nelsoni* Merriam, Proc. Biol. Soc. Washington, 10:173, December 29, 1896, type from west slope Mount Popocatepetl, 11,000 feet, México.

Range.—Canadian Life-zone of the mountains bounding the eastern, southern and western sides of the Valley of Mexico. *Marginal records.*—México: Monte Río Frío, 45 km. ESE Mexico City (Davis, 1944:401). Puebla: type locality. México: Mt. Popocatepetl (Nelson, 1909:280). Distrito Federal: 31 km. S Mexico City (30815 KU). México: Llano Grande, 3 km. W Tlalmanalco (28278 KU).

Genus Sylvilagus Gray—Cottontails and Allies

Revised by Nelson, N. Amer. Fauna, 29:58-158, August 31, 1909.

1867. *Sylvilagus* Gray, Ann. and Mag. Nat. Hist., 20 (ser. 3):221. Type, *Lepus sylvaticus* Bachman, *Lepus nuttalli mallurus* Thomas.

Total length, 291-538; tail, 18-73; hind foot, 71-110; ear from notch (dry) 41-74. Grayish to dark brownish above and lighter below; sutures of interparietal bone distinct throughout life; second to fourth cervical vertebrae broader than long with dorsal surface flattened and without carination.

The delectable flesh of members of this genus, the large numbers that occur on a small area, even in thickly settled rural areas, and the wariness that rabbits soon develop when much hunted, give them top ranking among small game mammals. Tens of thousands of cottontails in Kansas and Missouri (*Sylvilagus floridanus* and some *S. audubonii*) are captured alive, transported to the eastern United States and released there to bolster the local supply of game. Considering that certain ectoparasites are limited to certain hosts and that some ectoparasites transmit such diseases as Rocky Mountain Spotted Fever whereas other ectoparasites do not, this transplantation of rabbits is dangerous. Also, expenditure of $100.00 on improving the habitat for *Sylvilagus* in a given area in the eastern United States would produce more cottontails than the expenditure of the same sum for live animals, from the Middlewest, that are to be released (see Langenbach and Beule, 1942:14, 15 and 30).

Different species venture different distances from cover to feed. The Audubon cottontail of west-central California ventures a hundred feet and more from cover but the brush rabbit was never seen

(Orr, 1940:182) farther than 42 feet from cover. In the thirties, when a gladiolus farmer from the chaparral belt of Santa Clara County, California, visited the University of California seeking advice on how to prevent damage by "cottontails" to his gladioli plantings, we asked the farmer if brush rabbits or cottontails were responsible and suggested to the farmer, who was unable to distinguish between the two, that an animal be killed and submitted for identification. When this was done, the brush rabbit (*Sylvilagus bachmani*) was found to be responsible for the damage. Robert T. Orr's recommendation that the chaparral (brush) be cut back 45 feet from the gladioli plantings was reluctantly followed and proved to be effective. A letter from a Santa Clara County agricultural official a couple of years later expressed thanks for the recommendation made by Orr, and estimated that adoption of his recommendations saved farmers of that one county $40,000 annually. This incident illustrates how detailed knowledge of the life history of a given kind of animal and control of its environment, rather than direct "control" of the animal, is sometimes of value to man.

The genus *Sylvilagus* is restricted to the New World; the two species *Sylvilagus brasiliensis* and *S. floridanus* are the only two which occur in South America and they occur also in North America.

Subgenus BRACHYLAGUS Miller—Pigmy Rabbit

1900. *Brachylagus* Miller, Proc. Biol. Soc. Washington, 13:157, June 13. Type, *Lepus idahoensis* Merriam. For characters see subgenus *Sylvilagus*.

Sylvilagus idahoensis (Merriam)

Pigmy Rabbit

1891. *Lepus idahoensis* Merriam, N. Amer. Fauna, 5:76, July 30, type from head of Pahsimeroi Valley, near Goldburg, Custer County, Idaho (Davis, Recent Mammals of Idaho, p. 363, April 9, 1939).
1930. *Sylvilagus idahoensis*, Grinnell, Dixon and Linsdale, Univ. California Publ. Zool., 35:553, October 10.

Marginal records.—In southeastern Washington: Ritzville (Taylor and Shaw, 1929:29); Lind (243344 USBS); Warden (Taylor and Shaw, 1929: 29). In remainder of range: Montana: Bannack (Davis, 1937:27). Idaho: Trail Creek near Pocatello (Davis, 1939:366). Utah: 3 mi. NE Clarkson (Durrant, MS); W side Utah Lake (*ibid.*); 20 mi. W Parowan (*ibid.*); 10 mi. SW Cedar City (*ibid.*). Nevada: 8½ mi. NE Sharp (Hall, 1946:618); Fallon (Schantz, 1947:187). California: Bodie (Severaid, 1950:2); 5000 ft., 3 mi. S Ravendale (Orr, 1940:194). Oregon: Silver Lake (Bailey, 1936:110, fig. 17, 206518 USBS); Fremont (*ibid.*, 205005 USBS); Redmond (*ibid.*, 242302 USBS); 10 mi. N Baker (Dice, 1926:27). Idaho: type locality; Junction (Davis, 1939:366).

Total length, 250-290; tail, 20-30; hind foot, 65-72; ear from notch (dry), 36-48; weight, 6 ♂ 409(375-435), 9 ♀ 398(246-458) grams. Upper parts pinkish to blackish or dark grayish depending on amount of wear. The pigmy rabbit lives in burrows, mostly dug by itself, preferably where tall sagebrush grows densely. This species feeds extensively on sagebrush, at least in winter. Six young seem to be the rule and they are born any time from late in May until early in August.

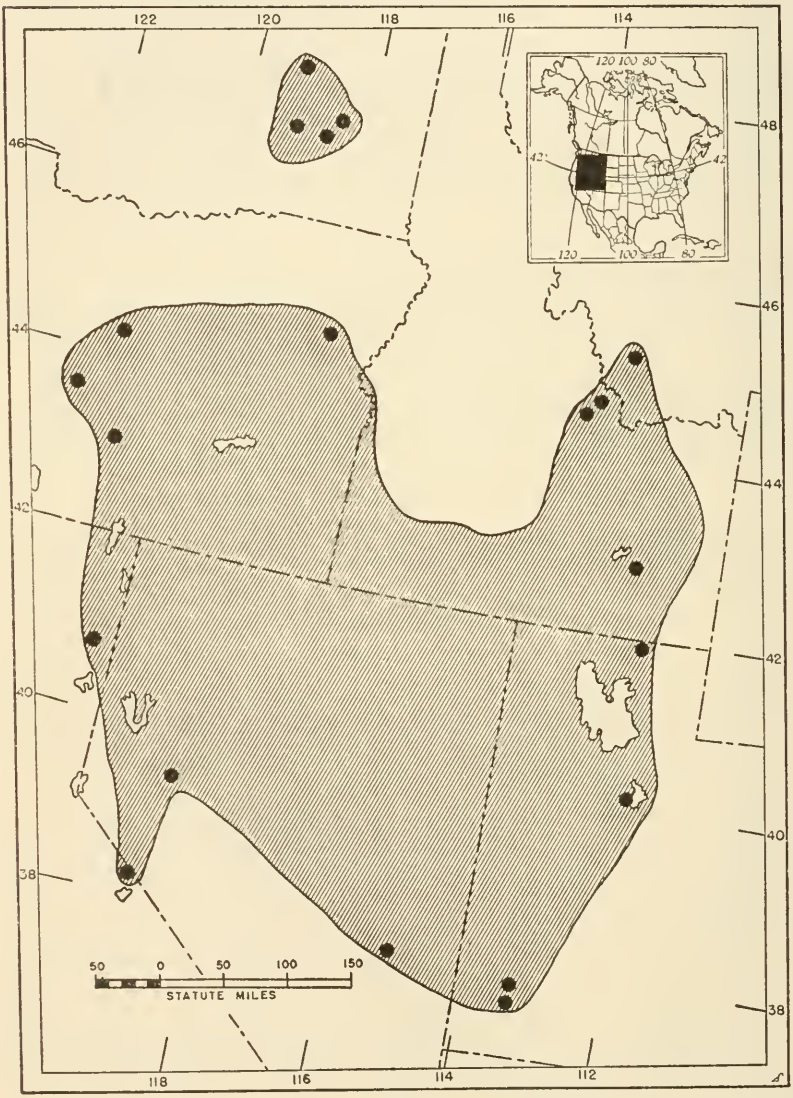


FIG. 7. Distribution of *Sylvilagus idahoensis*.

Subgenus SYLVILAGUS Gray—Cottontails and Allies

1867. *Sylvilagus* Gray, Ann. and Mag. Nat. Hist., 20 (ser. 3):221. Type, *Lepus sylvaticus* Bachman [= *Lepus nuttalli mallurus* Thomas].
1867. *Tapeti* Gray, Ann. and Mag. Nat. Hist., 20 (ser. 3):224, September. Type *Lepus brasiliensis* Linnaeus.
1897. *Microlagus* Trouessart, Catalogus Mammalium . . ., p. 660. Type, *Lepus cinerascens* J. A. Allen.
1897. *Limnolagus* Mearns, Science, n. s., 5:393, March 5. Type *Lepus aquaticus* Bachman.
1950. *Paludilagus* Hershkovitz, Proc. U. S. Nat. Mus., 100:333, May 26. Type *Lepus palustris* Bachman.

Characters of subgeneric worth, in contrast to those of the subgenus *Brachylagus,* are: First premolar, in upper jaw and in lower jaw, with more than one fold in the enamel; infolded enamel, which divides each molar tooth into two parts, crenate.

The many nominal species of the subgenus *Sylvilagus* belong to no more than 12 and perhaps to only ten full species. The now more abundant specimens than were available a half century ago reveal also that there are less trenchant differences between some of the species than were supposed to exist when the five names for genera or subgenera listed immediately above were proposed. Some species can be placed in each of two subgenera with almost equal propriety. If used, four of the five subgeneric names mentioned above would contain only one species each. It seems that no useful purpose is served by attempting to fit the several species of the genus *Sylvilagus* into more than the two subgenera *Brachylagus* and *Sylvilagus;* the other names, *Tapeti* Gray, *Microlagus* Trouessart, *Limnolagus* Mearns, and *Paludilagus* Hershkovitz, are here arranged as synonyms of the subgeneric name *Sylvilagus* Gray.

Sylvilagus brasiliensis

Forest Rabbit

Total length, 380-420; tail, 20-21; hind foot, 77-80; ear from notch (dry), 39-46. The principal characters of this species are small size, dark color, short tail, and dingy buffy (not white) undersurface of the tail. These rabbits rest in forests or other thick vegetative cover and do not venture far from such cover to feed.

SYLVILAGUS BRASILIENSIS CONSOBRINUS Anthony.

1917. *Sylvilagus gabbi consobrinus* Anthony, Bull. Amer. Mus. Nat. Hist., 37:335, May 28, type from Old Panamá, Panamá. Known from type locality only.
1950. *Sylvilagus brasiliensis consobrinus,* Hershkovitz, Proc. U. S. Nat. Mus., 100:353, May 26.

SYLVILAGUS BRASILIENSIS DICEI Harris.

1932. *Sylvilagus dicei* Harris, Occas. Papers Univ. Michigan, Mus. Zool., 248:1, August 4, type from 6000 ft., El Copey de Dota, in the Cordillera de Talamanca, Costa Rica.

1950. *Sylvilagus brasiliensis dicei*, Hershkovitz, Proc. U. S. Nat. Mus., 100: 352, May 26.

Marginal records.—Costa Rica (Goodwin, 1946:359); Rancho de Río Jimenez; Juan Viñas; type locality; *San José.*

Sylvilagus brasiliensis gabbi (J. A. Allen).

1877. *Lepus brasiliensis* var. *gabbi* J. A. Allen, Monogr. N. Amer. Rodentia, p. 349, August, type locality Costa Rica and Chiriquí; restricted by Nelson (N. Amer. Fauna, 29:259, August 31, 1909), by designation of type specimen, to Talamanca [= Sipurio, Río Sixaola, near Carribean Coast], Costa Rica.

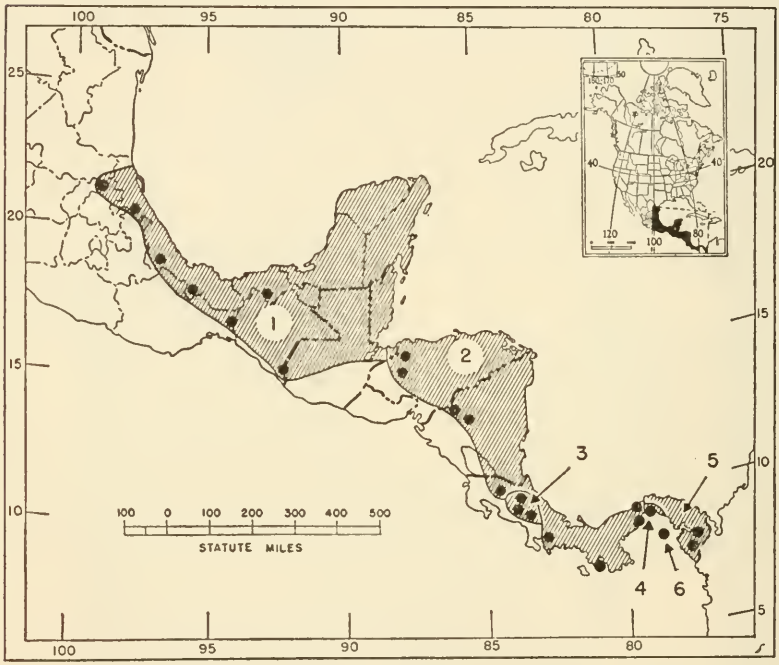


Fig. 8. Distribution of *Sylvilagus brasiliensis.*

1. *S. b. truei*
2. *S. b. gabbi*
3. *S. b. dicei*
4. *S. b. consobrinus*
5. *S. b. messorius*
6. *S. b. incitatus*

1950. *Sylvilagus brasiliensis gabbi*, Hershkovitz, Proc. U. S. Nat. Mus., 100: 351, May 26.

1908. *Lepus gabbi tumacus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 24:649, October 13, type from Tuma, Nicaragua.

Marginal records.—Honduras: San Pedro Sula (Nelson, 1909:261); to Gulf Coast and southward along coast to Panamá Canal, Panamá: Gatun (Goldman, 1920:146); Corozal (*ibid.*); Gobernador Island (*ibid.*); Divala (*ibid.*); *Chiriquí* (Goodwin, 1946:358). Northward east of the range of *S. b. dicei*, thence westward in Costa Rica: Vijaqual, San Carlos (Goodwin, 1946:358). Nicaragua: Matagalpa (Allen, 1910:96); Ocotal (*ibid.*). Honduras: San José, Santa Barbara (Goodwin, 1942:151).

SYLVILAGUS BRASILIENSIS INCITATUS (Bangs).

1901. *Lepus (Tapeti) incitatus* Bangs, Amer. Nat., 35:633, August, type from San Miguel Island, Bay of Panamá. Known from type locality only.
1950. *Sylvilagus brasiliensis incitatus,* Hershkovitz, Proc. U. S. Nat. Mus., 100:352, May 26.

SYLVILAGUS BRASILIENSIS MESSORIUS Goldman.

1912. *Sylvilagus gabbi messorius* Goldman, Smiths. Misc. Coll. 60 (no. 2): 13, September 20, type from Cana, 1800 ft., mts. of eastern Panamá.
1950. *Sylvilagus brasiliensis messorius,* Hershkovitz, Proc. U. S. Nat. Mus., 100:352, May 26.

Marginal records.—Panamá (Goldman, 1920:147): Boca de Cupe; *Tacarcuna; Tapalisa;* type locality.

SYLVILAGUS BRASILIENSIS TRUEI (J. A. Allen).

1890. *Lepus truei* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:192, December 10, type from Mirador, Veracruz.
1950. *Sylvilagus brasiliensis truei,* Hershkovitz, Proc. U. S. Nat. Mus., 100: 351, May 26.

Marginal records (Nelson, 1909:264, unless otherwise noted).—San Luis Potosí: Rancho Apetsco, Xilitla (Dalquest, 1950:4), thence down coast to Tabasco: Teapa. Chiapas: Huehuetan. Oaxaca: Santo Domingo. Veracruz: Buena Vista; Motzorongo. Puebla: Metlaltoyuca.

Sylvilagus bachmani

Brush Rabbit

Size small. Total length, 300-375; tail, 20-43; hind foot, 64-81; ear from notch (dry), 50-64; weight (topotypes of *S. b. macrorhinus*) 16 ♂ 679 (561-832), 22 ♀ 707 (517-843) grams. Body uniformly dark brown or brownish gray, but tail whitish beneath; hair on midventral part of body gray at base; only a slight crenulation of ridge of enamel which separates an individual molariform tooth into anterior and posterior sections. From *Sylvilagus audubonii,* the only other species of *Sylvilagus* in the same geographic area, *S. bachmani* differs in smaller size, less white on underparts (the hairs on the midventral part of the body being gray instead of white at base), shorter ears and legs, and a less crenulated ridge of enamel separating the anterior and posterior parts of a molariform tooth.

The brush rabbit is a Pacific Coastal species; as may be seen from figure 9 on the next page, this species occurs from the Columbia River on the north to the tip of Baja California on the south. Nowhere, so far as I can learn, does it occur as far east as the crest of the Cascade-Sierra Nevada Mountain Chain. Throughout its range the brush rabbit is closely associated with—in fact, lives in —the chaparral that is dense enough to afford protection from raptorial birds and the larger carnivorous mammals. The rabbit's

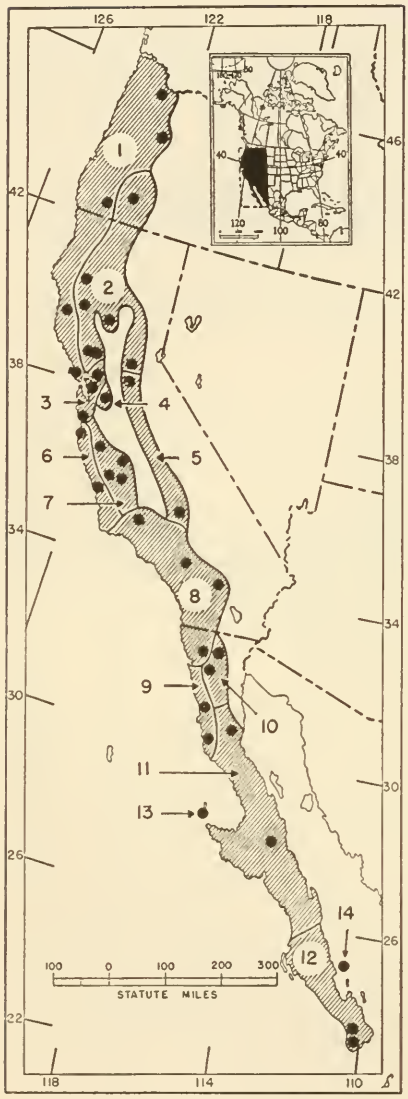


FIG. 9. Distribution of *Sylvilagus bachmani* and *Sylvilagus mansuetus*.

1. *S. b. ubericolor*
2. *S. b. tehamae*
3. *S. b. macrorhinus*
4. *S. b. riparius*
5. *S. b. mariposae*
6. *S. b. bachmani*
7. *S. b. virgulti*
8. *S. b. cinerascens*
9. *S. b. rosaphagus*
10. *S. b. howelli*
11. *S. b. exiguus*
12. *S. b. peninsularis*
13. *S. b. cerrosensis*
14. *S. mansuetus*

reliance on protective cover is so great that, as pointed out on an earlier page, a person can turn this trait to advantage in protecting cultivated crops from inroads that the rabbits might make on them. The protection is afforded by clearing the brush from a strip forty-five feet wide so that the cleared strip intervenes between the cultivated crops and the brushy shelter. The rabbits will not risk crossing the open strip and hence do not reach the growing crops.

Brush rabbits use simple "forms" in the brush for resting. Only one observer (Orr, 1940: 173) has reported an individual entering a hole. In patches of chaparral in which the rabbits live they make runways that are especially well defined at the edges of the brush. The outer entrance to a runway is tunnellike and one to two feet from the outer entrance there is a special form that serves as a lookout post. A brush rabbit that is about to venture into the open ordinarily pauses in such a form for several minutes, presumably to satisfy itself that no enemy is in the open area whither the rabbit is bound.

The breeding season is from January to June, at least in California. There are 2 to 5 young, averaging 3.5 per litter. They are born in a nest.

SYLVILAGUS BACHMANI BACHMANI (Waterhouse).

1839. *Lepus bachmani* Waterhouse, Proc. Zool. Soc. London, Pt. 6 (for 1838):103, February 7, type from California, probably between Monterey and Santa Barbara.
1904. *Sylvilagus (microlagus) bachmani,* Lyon, Smiths. Misc. Coll., 45:336, June 15.
1855. *Lepus trowbridgei* Baird, Proc. Acad. Nat. Sci. Philadelphia, p. 333, type from Monterey County, California.

Marginal records.—California (Orr, 1940:150): 2 mi. S mouth Salinas River; near Morro.

SYLVILAGUS BACHMANI CERROSENSIS (J. A. Allen).

1898. *Lepus cerrosensis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:145, April 12, type from Cerros [=Cedros] Island, Baja California. Known from type locality only.
1909. *Sylvilagus bachmani cerrosensis,* Nelson, N. Amer. Fauna, 29:255, August 31.

SYLVILAGUS BACHMANI CINERASCENS (J. A. Allen).

1890. *Lepus cinerascens* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:159, October 8, type from San Fernando, Los Angeles County, California.
1907. *Sylvilagus bachmani cinerascens,* Nelson, Proc. Biol. Soc. Washington, 20:84, July 22.

Marginal records.—California (Orr, 1940:168): 5700 ft., San Emigdio Canyon; 3 mi. E San Fernando; Reche Canyon (Orr, 1940:169); 3500 ft., Dos Palmas Springs, Santa Rosa Mts. Baja California (Nelson, 1909:253): La Huerta, thence northward up-coast to point of beginning.

SYLVILAGUS BACHMANI EXIGUUS Nelson.

1907. *Sylvilagus bachmani exiguus* Nelson, Proc. Biol. Soc. Washington, 20:84, July 22, type from Yubay, central Baja California.

Marginal records.—Baja California (Nelson, 1909:254): Agua Dulce; Santana.

SYLVILAGUS BACHMANI HOWELLI Huey.

1927. *Sylvilagus bachmani howelli* Huey, Trans. San Diego Soc. Nat Hist., 5:67, July 6, type from 10 mi. SE Alamo, Baja California, lat. 31° 35′ N, long. 116° 03′ W.

Marginal records.—Baja California (Huey, 1927:68): Laguna Hanson, Sierra Juarez; type locality.

SYLVILAGUS BACHMANI MACRORHINUS Orr.

1935. *Sylvilagus bachmani macrorhinus* Orr, Proc. Biol. Soc. Washington, 48:28, February 6, type from Alpine Creek Ranch, 3½ mi. S and 2⅓ mi. E Portola, 1700 ft., San Mateo County, California.

Marginal records.—California (Orr, 1940:163): 10 mi. SW Suisun; W side Mt. Diablo; Summit Station, Santa Cruz Mts., thence north along coast to Golden Gate.

SYLVILAGUS BACHMANI MARIPOSAE Grinnell and Storer.

1916. *Sylvilagus bachmani mariposae* Grinnell and Storer, Univ. California Publ. Zool., 17:7, August 23, type from McCauley Trail, 4000 ft., near El Portal, Mariposa County, California.

Marginal records.—California (Orr, 1940): Carbondale (p. 158); French Gulch, 6700 ft., Piute Mtn. (p. 159).

Sylvilagus bachmani peninsularis (J. A. Allen).

1898. *Lepus peninsularis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:144, April 12, type from Santa Anita, Baja California.
1909. *Sylvilagus bachmani peninsularis*, Nelson, N. Amer. Fauna, 29:255, August 31.

Marginal records.—Baja California (Nelson, 1909:255): type locality; Cape San Lucas.

Sylvilagus bachmani riparius Orr.

1935. *Sylvilagus bachmani riparius* Orr, Proc. Biol. Soc. Washington, 48:29, February 6, type from west side San Joaquin River, 2 mi. NE Vernalis, in Stanislaus County, California. Known from type locality only.

Sylvilagus bachmani rosaphagus Huey.

1940. *Sylvilagus bachmani rosaphagus* Huey, Trans. San Diego Soc. Nat. Hist., 9:221, July 31, type from 2 mi. W Santo Domingo Mission, Baja California, México, lat. 30° 45′ N, long. 115° 58′ W, or precisely, near the huge red cliff that marks the entrance of the Santo Domingo River Cañon from the coastal plain.

Marginal records.—Baja California (Huey, 1940): San Quintin (p. 223); El Rosario (p. 222).

Sylvilagus bachmani tehamae Orr.

1935. *Sylvilagus bachmani tehamae* Orr, Proc. Biol. Soc. Washington, 48: 27, February 6, type from Dale's, on Paine's Creek, 600 ft., Tehama County, California.

Marginal records.—Oregon (Orr, 1935:28): Prospect. California (Orr, 1940:156): Auburn; 7 mi. W and 14 mi. S Chico; Rumsey; Castle Springs; 3 mi. S Covelo; Mad River Bridge, S. Fork Mtn.

Sylvilagus bachmani ubericolor (Miller).

1899. *Lepus bachmani ubericolor* Miller, Proc. Acad. Nat. Sci. Philadelphia, p. 383, September 29, type from Beaverton, Washington County, Oregon.
1904. *Sylvilagus* (*Microlagus*) *bachmani ubericolor*, Lyon, Smiths. Misc. Coll., 45:337, June 15.

Range.—Columbia River, Oregon, south to San Francisco Bay, California, and from the Pacific Coast eastward to a line connecting the following marginal records.—Oregon (V. Bailey, 1936:109, unless otherwise noted): Portland (Nelson, 1909:251); Mackenzie Bridge; above Grants Pass. California (Orr, 1940:153): Laytonville; Maillard [= 4 mi. E Lagunitas].

Sylvilagus bachmani virgulti Dice.

1926. *Sylvilagus bachmani virgulti* Dice, Occas. papers Mus. Zool. Univ. Michigan, 166:24, February 11, Soledad, Monterey County, California.

Marginal records.—California (Orr, 1940:166): The Pinnacles; Waltham Cr., 4½ mi. SE Priest Valley; 2 mi. S San Miguel; Bryson.

Sylvilagus mansuetus

Brush Rabbit

1907. *Sylvilagus mansuetus* Nelson, Proc. Biol. Soc. Washington, 20:83, July 22, type from San José Island, Gulf of California, Baja California. Known from San José Island only.

This insular species is closely related to *Sylvilagus bachmani* and is distinguished by paleness, proportionately longer and narrower skull, fusion to skull of anterior arm of supraorbital process, and larger jugal.

Sylvilagus palustris

Marsh Rabbit

(See figure 42)

Total length, 425-440; tail, 33-39; hind foot, 88-91; ear from notch (dry), 45-52. Upper parts blackish brown or reddish brown; underside of tail brownish or dingy gray (not white); ears, tail and hind feet short; posterior and anterior extensions of supraorbital processes joined to skull along most (or all) of their extent. The lack of white on the underside of the tail is a ready means of distinguishing this species from the other species of the genus which occur within its geographic range. The species occurs in the lowlands, possibly not above 500 feet altitude, of the Lower Austral and Tropical life-zones. In Florida, Blair (1936) found that the marsh rabbit ate 29 per cent of its bodily weight in green food each day and that the number of embryos in 3 females was 4, 4 and 3.

SYLVILAGUS PALUSTRIS PALUDICOLA (Miller and Bangs).

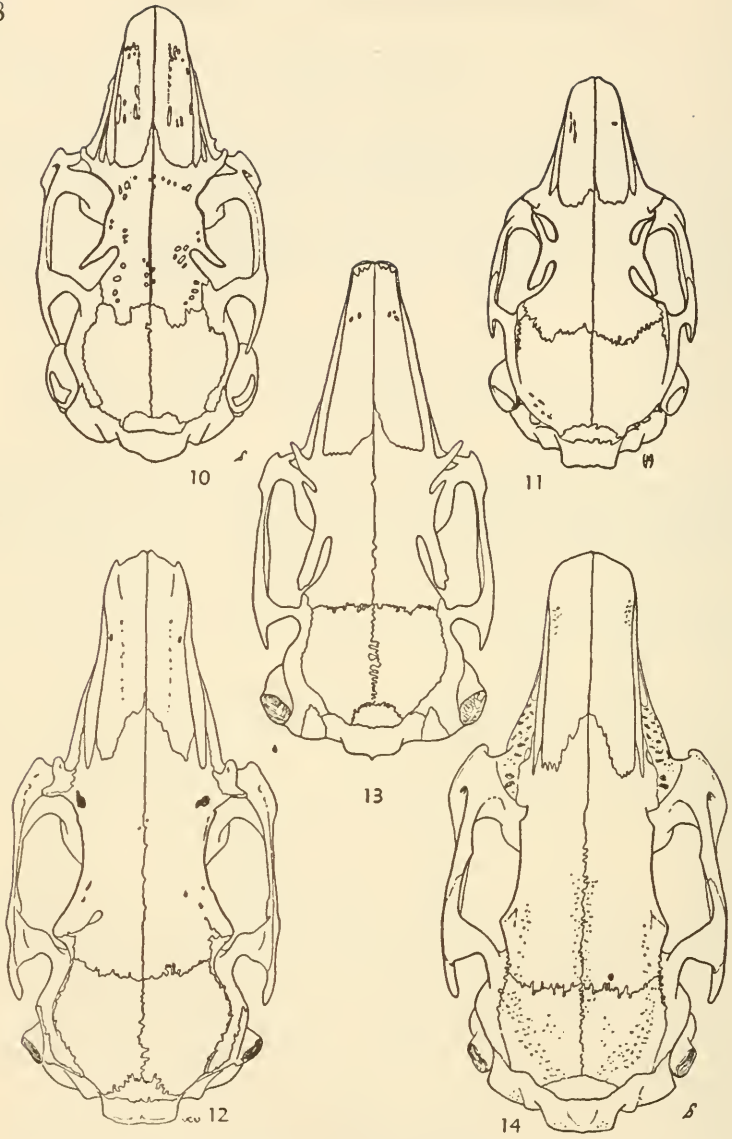
1894. *Lepus paludicola* Miller and Bangs, Proc. Biol. Soc. Washington, 9:105, June 9, type from Ft. Island, near Crystal Riv., Citrus Co., Fla.
1909. *Sylvilagus palustris paludicola,* Nelson, N. Amer. Fauna, 29:269, August 31.

Marginal records.—Florida (Nelson, 1909:270): Hibernia [= Green Cove Springs]; San Mateo; along Atlantic Coast at least to Micco; Kissimmee River; Cape Sable; northward along Gulf Coast and on coastal islands at least to Suwanee River.

SYLVILAGUS PALUSTRIS PALUSTRIS (Bachman).

1837. *Lepus palustris* Bachman, Jour. Acad. Nat. Sci. Philadelphia, 7:194, type locality eastern South Carolina.
1909. *Sylvilagus palustris,* Nelson, N. Amer. Fauna, 29:266, August 31.

Marginal records.—Nansemond County (Handley and Patton, 1947:190), southward along Atlantic Coast to northern Florida: Anastasia Island (Nelson, 1909:269). West to Gulf Coast and along Coast to Alabama: Bon Secour (Nelson, 1909:269); Flomaton (Howell, 1921:74); Dothan (*ibid.*). Georgia: Americus (Nelson, 1909:269). South Carolina: Society Hill (*ibid.*).



FIGS. 10-14. Dorsal views of skulls of rabbits. All × 1.

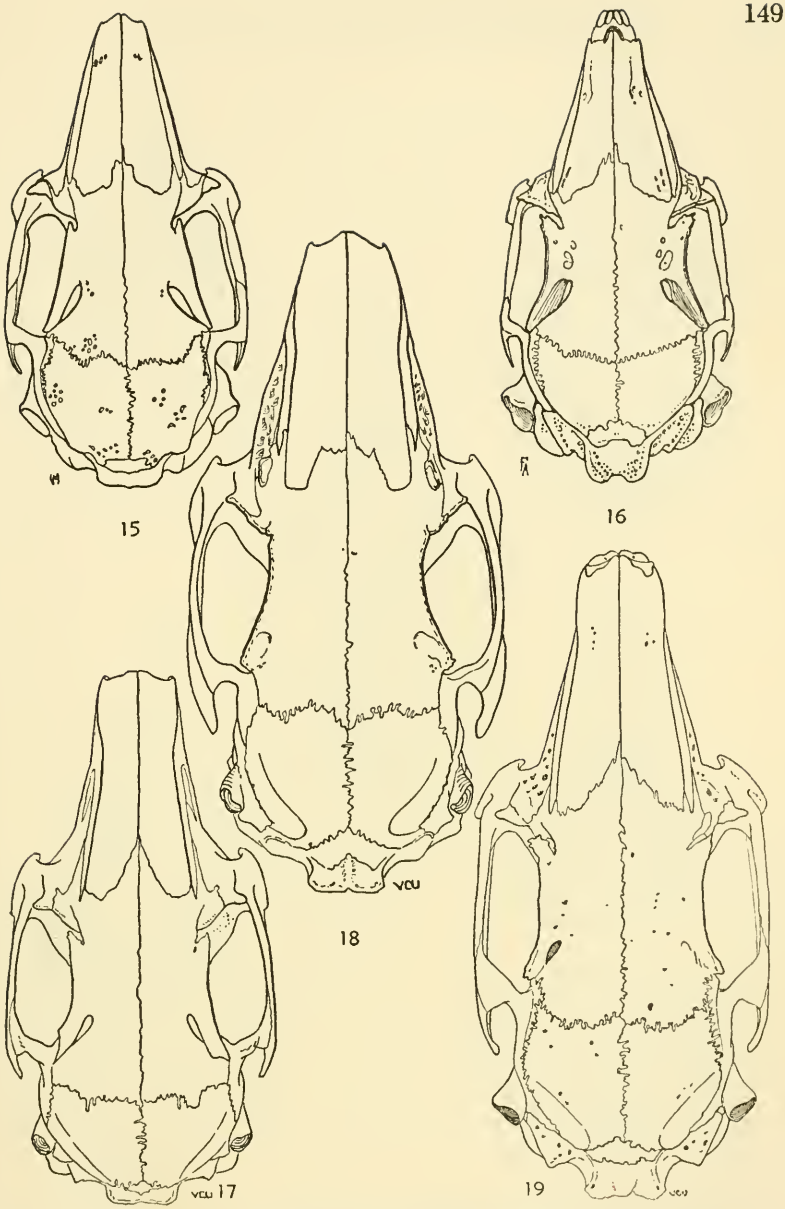
FIG. 10. *Romerolagus diazi*, 31 km. S Mexico City, D. F. No. 30815 KU, ♀.

FIG. 11. *Sylvilagus idahoensis*, Millett P. O., Nevada. No. 37275 MVZ, ♂.

FIG. 12. *Sylvilagus brasiliensis truei*, 30 km. SSE Jesus Carranza, Veracruz. No. 32128 KU, ♂.

FIG. 13. *Sylvilagus bachmani macrorhinus*, 1700 feet, Alpine Creek Ranch, San Mateo County, California. No. 53382 MVZ, ♀.

FIG. 14. *Sylvilagus palustris palustris*, Riceboro, Georgia. No. 45502 USNM, ♀. (After Nelson, 1909: pl. 12, fig. 3.)



FIGS. 15-19. Dorsal views of skulls of rabbits. All × 1.

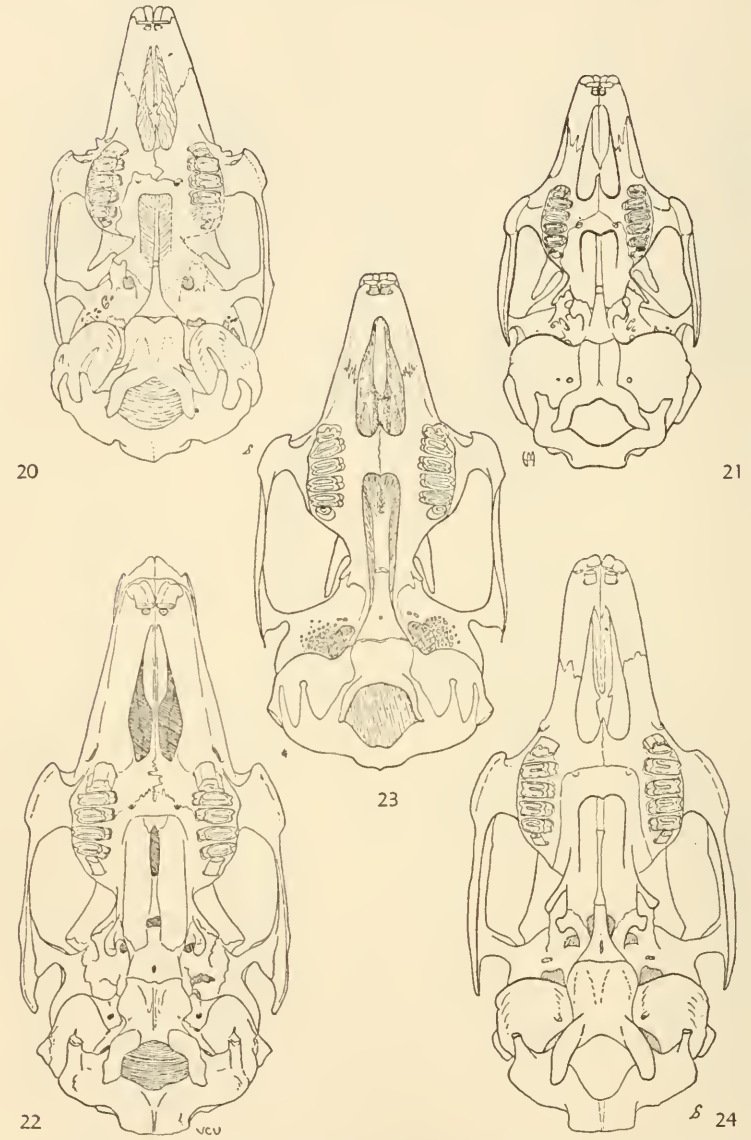
FIG. 15. *Sylvilagus nuttallii grangeri,* ½ mi. E. Jefferson, Nev. No. 58527, ♀.

FIG. 16. *Sylvilagus audubonii minor,* 3290 ft., Neville Spring, Grapevine Mts., Big Bend, Brewster Co., Texas. No. 80519 MVZ, ♂.

FIG. 17. *Sylvilagus floridanus mearnsi,* 4 mi. NE Lawrence, Douglas Co., Kansas. No. 3774 KU, ♂.

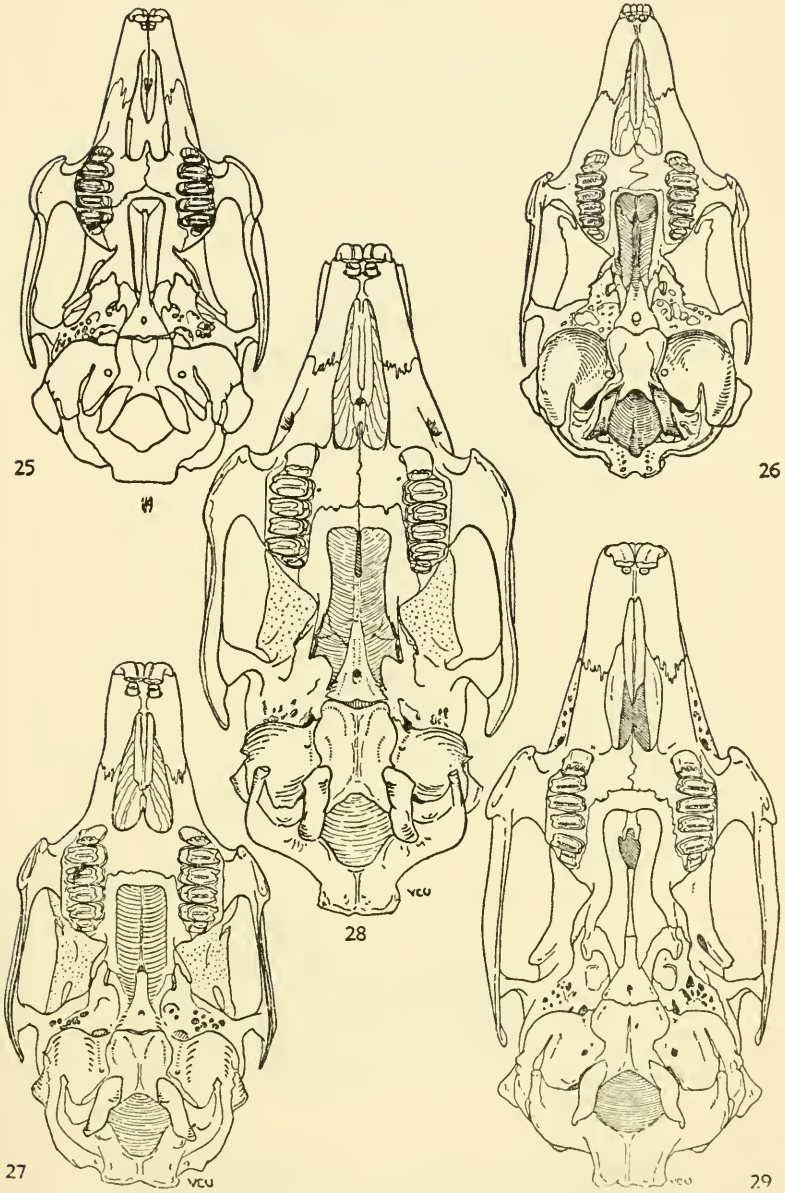
FIG. 18. *Sylvilagus a. aquaticus,* Crawford Co., Kansas. No. 8544 KU. ♂.

FIG. 19. *Sylvilagus cunicularius cunicularius,* 3 km. W Acultzingo, Veracruz. No. 30749 KU, ♂.



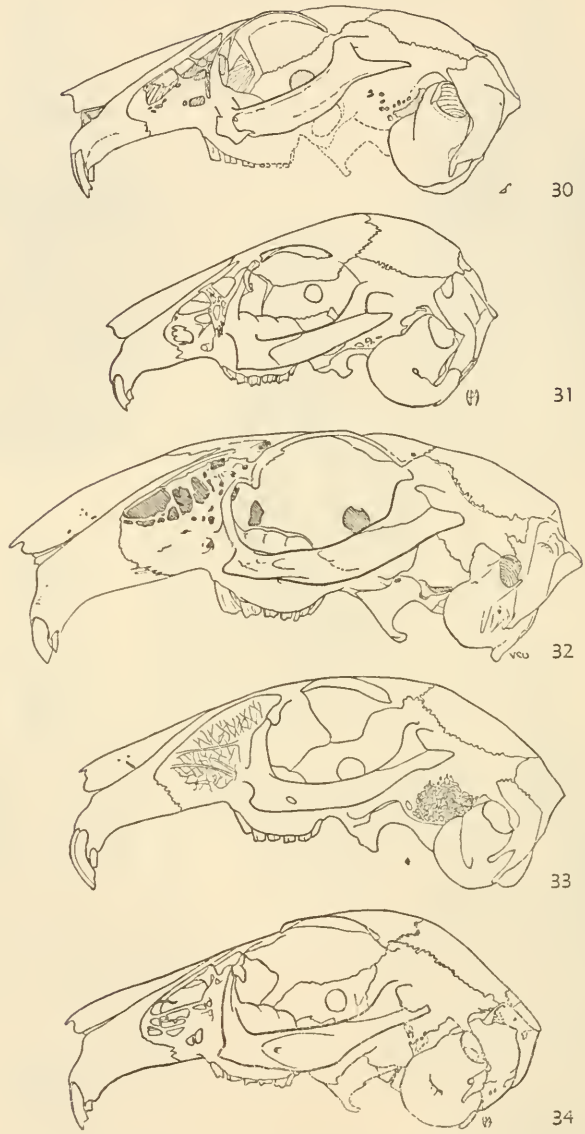
Figs. 20-24. Ventral views of skulls of rabbits. All × 1. Different views of the first four of these skulls are shown in figs. 10-13.

Fig. 20. *Romerolagus diazi*
Fig. 21. *Sylvilagus idahoensis*
Fig. 22. *Sylvilagus brasiliensis truei*
Fig. 23. *Sylvilagus bachmani macrorhinus*
Fig. 24. *Sylvilagus palustris palustris*, Society Hill, South Carolina. No. 2089 USNM (after Lyon, 1904: pl. 76, fig. 6).



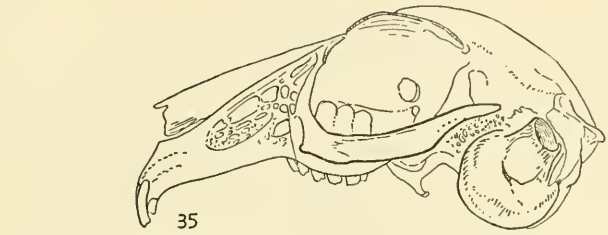
FIGS. 25-29. Ventral views of skulls of rabbits. All × 1. Different views of these skulls are shown in figs. 15-19.

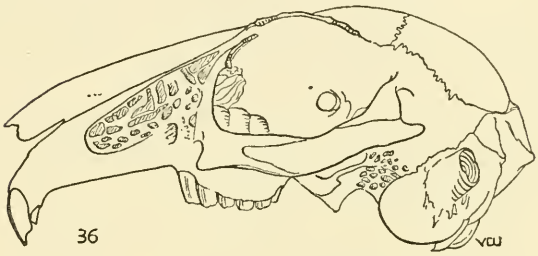
FIG. 25. *Sylvilagus nuttallii grangeri.* FIG. 27. *Sylvilagus floridanus mearnsi.*
FIG. 26. *Sylvilagus audubonii minor.* FIG. 28. *Sylvilagus aquaticus aquaticus.*
FIG. 29. *Sylvilagus cunicularius cunicularius.*

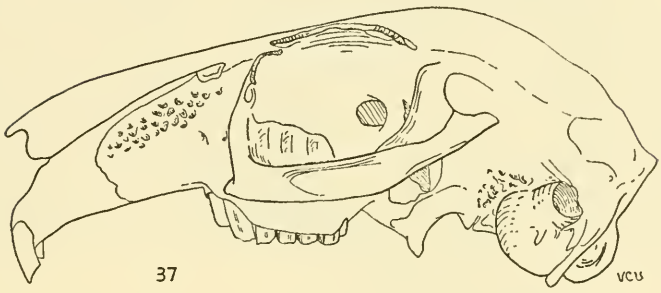


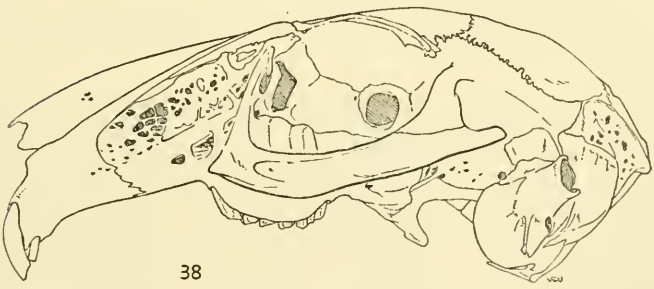
FIGS. 30-34. Lateral views of skulls of rabbits. All × 1. Different views of these skulls are shown in figs. 10-15.

FIG. 30. *Romerolagus diazi.*
FIG. 31. *Sylvilagus idahoensis.*
FIG. 32. *Sylvilagus brasiliensis truei.*
FIG. 33. *Sylvilagus bachmani macrorhinus.*
FIG. 34. *Sylvilagus nuttallii grangeri.*









FIGS. 35-38. Lateral views of skulls of rabbits. All × 1. Different views of these skulls are shown in figs. 16-19.

FIG. 35. *Sylvilagus audubonii minor.*
FIG. 36. *Sylvilagus floridanus mearnsi.*
FIG. 37. *Sylvilagus aquaticus aquaticus.*
FIG. 38. *Sylvilagus cunicularius cunicularius*

Sylvilagus floridanus

Florida Cottontail

Total length, 375-463; tail, 39-65; hind foot, 87-104; ear from notch (dry), 49-68; upper parts brownish or grayish; underside of tail white; skull with transversely thick posterior extension of supraorbital process of frontal. The geographic range is the largest of all of the North American species of the genus *Sylvilagus;* from Canada the species occurs south at least to Costa Rica and it may occur in Panamá for the species is recorded also from South America.

In the western part of the Great Plains this species is confined to the riparian growth along streams and *Sylvilagus audubonii* occupies the remainder of the terrain. In New Mexico and southwestern Texas *S. floridanus* is confined to the boreal life-zones where timber provides denser cover than is found in the lower life-zones. The zonal range is from the Canadian Life-zone into the Tropical Life-zone. It is not surprising, therefore, that there is much geographic variation in the shape and size of the skull. There is so much geographic variation in the skull that it is impossible, at this writing at least, to frame a description that will enable the reader to distinguish the skull from those of all other species of the genus. In any given area, however, it is possible, easily and certainly, to distinguish the skulls of *S. floridanus* from those of the other species which occur in that area.

Sylvilagus floridanus alacer (Bangs).

1896. *Lepus sylvaticus alacer* Bangs, Proc. Biol. Soc. Washington, 10:136, December 28, type from Stilwell, Boston Mountains, Adair County, Oklahoma.

Marginal records.—Missouri (Nelson, 1909:176): Columbia; St. Louis. Illinois: Ozark (Necker and Hatfield, 1941:56). Tennessee (Nelson, 1909:176): Samburg; Raleigh. Mississippi (Nelson, 1909:176): Michigan City; Bay St. Louis. Texas (Nelson, 1909:176): Port Lavaca; Brazos; Henrietta. Oklahoma: Norman (Blair, 1939:128). Kansas: *8 mi. NE Harper* (12917 KU); Rago (12508 KU); Halstead (3110 KU); *4 mi.* S and *14 mi. W Hamilton* (13673 KU); 3 mi. N Chanute (22026 KU).

Sylvilagus floridanus ammophilus A. H. Howell.

1939. *Sylvilagus floridanus ammophilus* A. H. Howell, Jour. Mamm., 20: 365, August 14, type from "Oak Lodge", on peninsula opposite Micco, Florida. Known from type locality only.

SYLVILAGUS FLORIDANUS AZTECUS (J. A. Allen).

1890. *Lepus sylvaticus aztecus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:188, December 10, type from Tehuantepec City, Oaxaca.
1904. *Sylvilagus (Sylvilagus) floridanus aztecus*, Lyon, Smiths. Misc. Coll., 45:336, June 15.

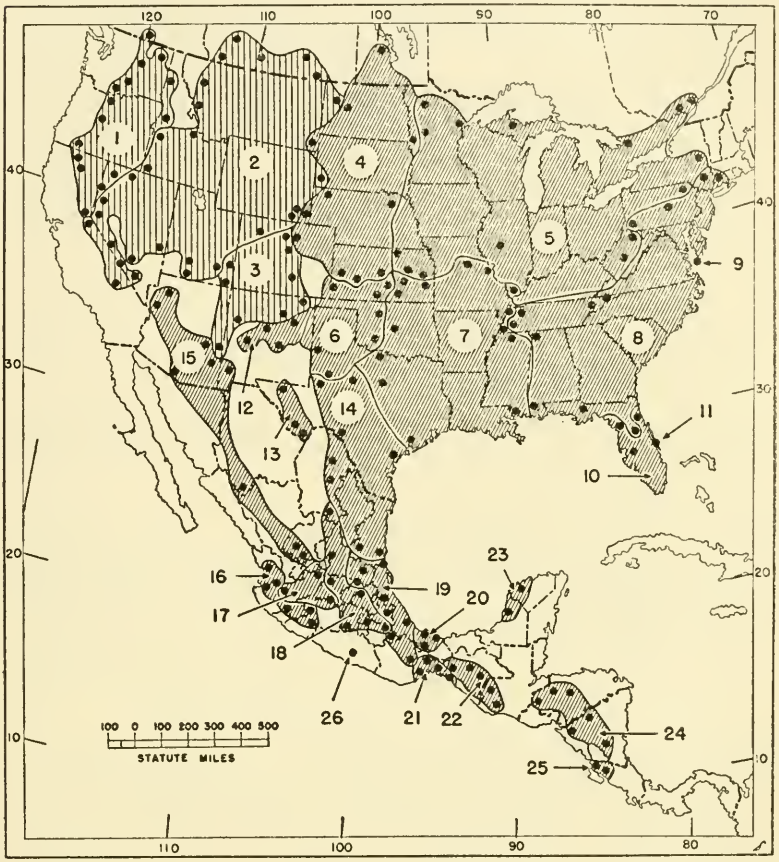


FIG. 39. Distribution of *Sylvilagus nuttallii*, *S. floridanus* and *S. insonus*.

Guide to kinds:
1. *S. n. nuttallii*
2. *S. n. grangeri*
3. *S. n. pinetis*
4. *S. f. similis*
5. *S. f. mearnsi*
6. *S. f. llanensis*
7. *S. f. alacer*
8. *S. f. mallurus*
9. *S. f. hitchensi*
10. *S. f. floridanus*
11. *S. f. ammophilus*
12. *S. f. cognatus*
13. *S. f. robustus*
14. *S. f. chapmani*
15. *S. f. holzneri*
16. *S. f. restrictus*
17. *S. f. subcinctus*
18. *S. f. orizabae*
19. *S. f. connectens*
20. *S. f. russatus*
21. *S. f. aztecus*
22. *S. f. chiapensis*
23. *S. f. yucatanicus*
24. *S. f. hondurensis*
25. *S. f. costaricensis*
26. *S. insonus*

Marginal records (Nelson, 1909:188, unless otherwise noted).—Oaxaca: Santa Maria Petapa; Santa Efigenia. Chiapas: Tonala, 50 M (Hooper, 1947:56). Oaxaca: Salina Cruz; *type locality.*

Sylvilagus floridanus chapmani (J. A. Allen).

1899. *Lepus floridanus chapmani* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 12:12, March 4, type from Corpus Christi, Nueces County, Texas.
1904. *Sylvilagus (Sylvilagus) floridanus chapmani,* Lyon, Smiths. Misc. Coll., 45:336, June 15.
1899. *Lepus floridanus caniclunis* Miller, Proc. Acad. Nat. Sci. Philadelphia, p. 388, October 5, type from Fort Clark, Kinney County, Texas.
1902. *Lepus simplicicanus* Miller, Proc. Biol. Soc. Washington, 15:81, April 25, type from Brownsville, Cameron County, Texas.

Marginal records (Nelson, 1909:178).—Texas: Clyde; Victoria County; *Rockport.* Tamaulipas: Soto la Marina; Juamave. Coahuila: Monclova; Sabinas. Texas: Comstock; Stanton.

Sylvilagus floridanus chiapensis (Nelson).

1904. *Lepus floridanus chiapensis* Nelson, Proc. Biol. Soc. Washington, 17:106, May 18, type from San Cristobal, Chiapas.
1909. *Sylvilagus floridanus chiapensis,* Lyon and Osgood, Bull. U. S. Nat. Mus., 62:32, January 28.

Marginal records (Nelson, 1909:190, unless otherwise noted).—Chiapas: type locality; Comitan. Guatemala: Hacienda Chancol; Panajachel (Goodwin, 1934:56). Chiapas: Tuxtla.

Sylvilagus floridanus cognatus Nelson.

1907. *Sylvilagus cognatus* Nelson, Proc. Biol. Soc. Washington, 20:82, July 22, type from near summit of the Manzano Mountains, Valencia County, New Mexico.
1951. *Sylvilagus floridanus cognatus,* Hall and Kelson, Univ. Kansas Publ., Mus. Nat. Hist., 5:55, October 1, 1951.

Marginal records (Nelson, 1909:193).—New Mexico: Santa Rosa, 35 mi. N on Conchas River; Capitan Mts.; Datil Mts.; type locality.

Sylvilagus floridanus connectens (Nelson).

1904. *Lepus floridanus connectens* Nelson, Proc. Biol. Soc. Washington, 17:105, May 18, type from Chichicaxtle, central Veracruz.
1909. *Sylvilagus floridanus connectens,* Lyon and Osgood, Bull. U. S. Nat. Mus., 62:32, January 28.

Marginal records (Nelson, 1909:186).—Tamaulipas: Altamira. Veracruz: type locality. Oaxaca: Mt. Zempoaltepec. Veracruz: Orizaba (City of); Jico. Puebla: Metlaltoyuca. Queretaro: Pinal de Amoles. San Luis Potosí: Valles.

Sylvilagus floridanus costaricensis Harris.

1933. *Sylvilagus floridanus costaricensis* Harris, Occas. Papers Mus. Zool., Univ. Michigan, 266:3, June 28, type from Hacienda Santa Maria, Province of Guanacaste, 3200 ft., Costa Rica.

Marginal records (Goodwin, 1946:358).—Costa Rica: El Pelón; type locality; Tenorio.

SYLVILAGUS FLORIDANUS FLORIDANUS (J. A. Allen).

1890. *Lepus sylvaticus floridanus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:160, October 8, type from Sebastian River, Brevard County, Florida.
1904. *Sylvilagus floridanus,* Lyon, Smiths. Misc. Coll., 45:322, June 15.

Marginal records.—Florida: San Mateo (Sherman, 1936:122); *Enterprise* (*ibid.*); Miakka Lake (230812 USBS); Blitches Ferry (Sherman, 1936:122).

SYLVILAGUS FLORIDANUS HITCHENSI Mearns.

1911. *Sylvilagus floridanus hitchensi* Mearns, Proc. U. S. Nat. Mus., 39:227, January 9, type from Smiths Island, Northampton County, Virginia.

Marginal records.—Virginia: type locality; Fishermans Island (Handley and Patton, 1947:187).

SYLVILAGUS FLORIDANUS HOLZNERI (Mearns).

1896. *Lepus sylvaticus holzneri* Mearns, Proc. U. S. Nat. Mus., 18:554, June 24, type from Douglas spruce zone, near summit of Huachuca Mountains, Cochise County, Arizona.
1904. *Sylvilagus* (*Sylvilagus*) *floridanus holzneri,* Lyon, Smiths. Misc. Coll., 45:336, June 15.
1896. [*Lepus sylvaticus*] subspecies *rigidus* Mearns, Proc. U. S. Nat. Mus., 18:555, June 24, type from Carrizalillo Mts., near monument No. 31, Mexican boundary line, Grant County, New Mexico.
1903. *Lepus* (*Sylvilagus*) *durangae* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 19:609, November 12, type from Rancho Bailon, northwestern Durango.

Marginal records.—Arizona: Pine Springs, 15 mi. S of Canyon of Colorado (Hall and Kelson, 1951:54); Reynolds Creek R. S., Sierra Ancha Mts. (*ibid.*); W base Mt. Turnbull, 4500 ft. (*ibid.*). New Mexico: Silver City (Nelson, 1909:180); *Animas Mts.* (*ibid.*). Zacatecas: Valparaiso (*ibid.*); Plateado (*ibid.*). Chihuahua: Guadalupe y Calvo (*ibid.*). Arizona: Thomas Cañon, 2 mi. E Baboquivari Mts. (Hall and Kelson, 1951:54), Hualapi Mts. (*ibid.*).

SYLVILAGUS FLORIDANUS HONDURENSIS Goldman.

1932. *Sylvilagus floridanus hondurensis* Goldman, Proc. Biol. Soc. Washington, 45:122, July 30, type from Monte Redondo, approximately 30 mi. NW Tegucigalpa, 5100 ft., Honduras.

Marginal records.—Honduras: Santa Barbara (Goodwin, 1942:150); Cedros (*ibid.*). Nicaragua: Jinotega (Nelson, 1909:190); Chontales ["District" of] (*ibid.*); Leon. Honduras: Ocotepeque (Goodwin, 1942:150).

SYLVILAGUS FLORIDANUS LLANENSIS Blair.

1938. *Sylvilagus floridanus llanensis* Blair, Occas. Papers. Mus. Zool., Univ. Michigan, 380:1, June 21, type from Old "F" Ranch headquarters, Quitaque, Briscoe County, Texas.

Marginal records.—Kansas: 15 mi. N and 3 mi. E Stafford (5547 KU); 1 mi. NE Aetna (12144 KU). Oklahoma: 3 mi SE Southard (10063 KU); *Fort Cobb* (Blair, 1939:129); Mt. Scott (*ibid.*). Texas: 6 mi. E Coahoma (Blair, 1938:3); 6 mi. southwest of Muleshoe (*ibid.*). Kansas: Coolidge (18462 KU).

Sylvilagus floridanus mallurus (Thomas).

1898. *L[epus]. n[uttalli]. mallurus* Thomas, Ann. and Mag. Nat. Hist., 2(ser. 7):320, October, type from Raleigh, Wake County, North Carolina.
1904. *Sylvilagus floridanus mallurus,* Lyon, Smiths. Misc. Coll., 45:323, June 15.
1837. *Lepus sylvaticus* Bachman, Jour. Acad. Nat. Sci. Philadelphia, 7:403, no type or type locality. Name given to the "common gray rabbit" of the eastern United States and probably with particular reference to the animal in South Carolina. Name preoccupied by *Lepus borealis sylvaticus* Nilson, 1832, from Sweden.

Marginal records.—Connecticut: Bear Mountain (Goodwin, 1935:163), south along coast to Florida: Lake Julian (Nelson, 1909:168); Rock Bluff (Sherman, 1936:122). Alabama: Bayou Labatre (A. H. Howell, 1921:71); Leighton (*ibid.*). Tennessee (Kellogg, 1939:291): Arlington; Hornbeak; Highcliff; Watauga Valley. West Virginia: *Ernshaw* (Kellogg, 1937:472). Pennsylvania (Nelson, 1909:169): Waynesburg; Potts Grove. New York: Palenville (*ibid.*).

Sylvilagus floridanus mearnsii (J. A. Allen).

1894. *Lepus sylvaticus mearnsii* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:171, May 31, type from Fort Snelling, Hennepin County, Minnesota.
1904. *Sylvilagus (Sylvilagus) floridanus mearnsi,* Lyon, Smiths. Misc. Coll., 45:336, June 15.

Marginal records.—Minnesota: Fertile (Swanson, Surber and Roberts, 1945:97); Duluth (*ibid.*). Michigan: Marquette County (Burt, 1946:249). Ontario: Lake Simcoe (Miller, 1924:464). Quebec (Anderson, 1947): Montreal (p. 103); Quebec-side Ottawa River in Laurentian Hills (p. 104). New York: "eastern New York" (Hamilton, 1943:383). Pennsylvania: Lopez (Nelson, 1909:172). West Virginia: 7 mi. E Phillipi (Kellogg, 1937: 473); Gilboa (*ibid.*). Illinois: Sangamon (Nelson, 1909:172). Kansas: Neosho Falls (5104 KU); 1 mi. N and ½ mi. E Lincolnville (12964 KU); *6 mi. SW Clay Center* (12398 KU); Strawberry (4510 KU). Minnesota: Otter Tail County (Surber, 1932:74).

Sylvilagus floridanus orizabae (Merriam).

1893. *Lepus orizabae* Merriam, Proc. Biol. Soc. Washington, 8:143, December 29, type from Mt. Orizaba, 9500 ft., Puebla.
1909. *Sylvilagus floridanus orizabae,* Nelson, N. Amer. Fauna, 29:183, August 31.
1903. *Lepus floridanus persultator* Elliott, Field Columb. Mus., publ. 71, zool. ser., 3:147, March 20, type from Puebla, Puebla.

Marginal records (Nelson, 1909:185).—Coahuila: Sierra Encarnación. Hidalgo: Encarnación. Veracruz: *Las Vigas;* Mt. Orizaba. *Puebla*: *Chalchicomula.* México: Mt. Popocatepetl; Volcano of Toluca. Guanajuato: Santa Rosa. San Luis Potosí: San Luis Potosí.

Sylvilagus floridanus restrictus Nelson.

1907. *Sylvilagus floridanus restrictus* Nelson, Proc. Biol. Soc. Washington, 20:82, July 22, type from Zapotlan, Jalisco.

Marginal records (Nelson, 1909:183).—Nayarit: Tepic; Ojo de Agua. Jalisco: *La Cienega; Atenguillo.* Michoacán: Mt. Tancítaro; Pátzcuaro. Jalisco: type locality; Las Canoas; La Laguna.

SYLVILAGUS FLORIDANUS ROBUSTUS (V. Bailey).

1905. *Lepus pinetus robustus* V. Bailey, N. Amer. Fauna, 25:159, October 24, type from 6000 ft., Davis Mts., Jeff Davis County, Texas.
1951. *Sylvilagus floridanus robustus,* Hall and Kelson, Univ. Kansas Publ., Mus. Nat. Hist., 5:56, October 1, 1951.

Marginal records.—Texas: The Bowl, Guadalupe Mts. (Hall and Kelson, 1951:56); Chisos Mts. (Nelson, 1909:195); 35 mi. S Marfa (*ibid.*).

SYLVILAGUS FLORIDANUS RUSSATUS (J. A. Allen).

1904. *Lepus* (*Sylvilagus*) *russatus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 20:31, February 29, type from Pasa Nueva, southern Veracruz.
1909. *Sylvilagus floridanus russatus,* Nelson, N. Amer. Fauna, 29:186, August 31.

Marginal records (Nelson, 1909:187).—Veracruz: Catemaco; Coatzacoalcos; *Minatitlan;* type locality; *Jimba* (KU 19895).

SYLVILAGUS FLORILANUS SIMILIS Nelson.

1907. *Sylvilagus floridanus similis* Nelson, Proc. Biol. Soc. Washington, 20:82, July 22, type from Valentine, Cherry County, Nebraska.

Marginal records.—Manitoba: Dauphin (Anderson and Rand, 1943:24). Minnesota: Ten Mile Lake (Surber, 1932:74). Nebraska: Neligh (Nelson, 1909:174). Kansas: *Long Island* (*ibid.*); 3 mi. N and 2 mi. W Hoisington (16509 KU); Lane County (5520 KU); Elkader (5595 KU). Colorado: Arvada (Cary, 1911:158). Wyoming: 6400 ft., 3 mi. E Horse Creek, P. O. (15936 KU). Nebraska: 8 mi. E Chadron (39380 KU). Montana: *Little Missouri River, 7 mi. NE Albion* (Hall and Kelson, 1951:52); Box Elder Creek, 25 mi. SW Sykes (*ibid.*). North Dakota: Oakdale (Bailey, 1927:134).

SYLVILAGUS FLORIDANUS SUBCINCTUS (Miller).

1899. *Lepus floridanus subcinctus* Miller, Proc. Acad. Nat. Sci. Philadelphia, p. 386, October 5, type from Hacienda El Molino, near Negrete, Michoacán.
1904. *Sylvilagus floridanus subcinctus,* Lyon, Smiths. Misc. Coll., 45:336, June 15.

Marginal records (Nelson, 1909:181). — Jalisco: Lagos. Guanajuato: Acámbaro. Michoacán: *Querendaro.* Jalisco: *Ameca;* Etzatlán.

SYLVILAGUS FLORIDANUS YUCATANICUS (Miller).

1899. *Lepus floridanus yucatanicus* Miller, Proc. Acad. Nat. Sci. Philadelphia, p. 384, September 29, type from Mérida, Yucatán.
1904. *Sylvilagus floridanus yucatanicus,* Lyon, Smiths. Misc. Coll., 45:336, June 15.

Marginal records (Nelson, 1909:191).—Yucatán: Progreso; type locality. Campeche: Campeche.

Sylvilagus transitionalis (Bangs)

New England Cottontail

1895. *Lepus sylvaticus transitionalis* Bangs, Proc. Boston Soc. Nat. Hist., 26:405, January 31, type from Liberty Hill, New London County, Connecticut.
1909. *Sylvilagus transitionalis,* Nelson, N. Amer. Fauna, 29:195, August 31.

Marginal records.—Vermont: west side at Canadian boundary (Osgood, F. L., Jr., 1938:440); Montpelier (*ibid.*). Maine: Sagadahoc County (Palmer, 1944:194); *Androscoggin County* (*ibid.*). New York: Miller

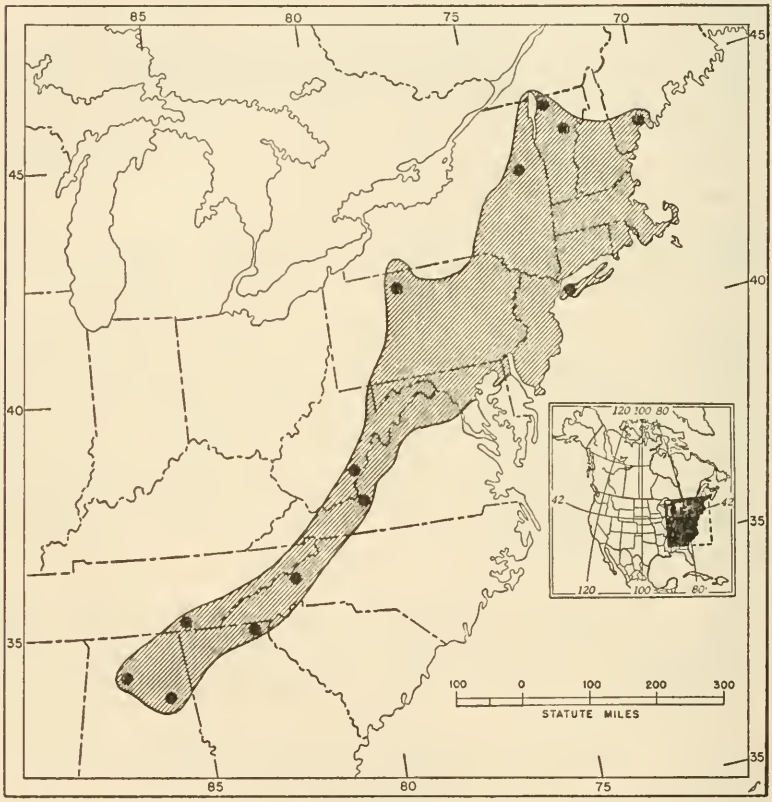


Fig. 40. Distribution of *Sylvilagus transitionalis.*

Place (Nelson, 1909:199). Virginia: Roanoke County (Llewellyn and Handley, 1946:385). North Carolina: Roan Mtn. (Nelson, 1909:199). Georgia: Brasstown Bald Mtn. (A. H. Howell, 1921:71). Alabama: Erin (*ibid.*); Ardell (*ibid.*). Tennessee: Walden Ridge, "near" Soddy (Kellogg, 1939:291). West Virginia: Ronceverte (Kellogg, 1937:473). Pennsylvania: Renovo (Nelson, 1909:199). New York: Lake George (*ibid.*).

Total length, 388; tail, 39; hind foot, 95; ear from notch (dry), 52. Upper parts almost pinkish buff, varying to almost ochraceous buff; back overlaid by a distinct black wash giving a penciled effect; anterior extension of supraorbital process obsolete or short and closely appressed to orbital rim; tympanic bullae small, smaller than in any subspecies of *S. floridanus* in the United States. *S. transitionalis* is a forest-inhabiting species—more so than is *S. floridanus.*

Sylvilagus nuttallii

Nuttall Cottontail

(See figure 39)

Total length, 350-390; tail, 44-50; hind foot, 88-100; ear from notch (dry), 55-56; weight in Nevada, ♂ 678, 3 ♀ 928 (868-1032) grams. Hind feet densely covered with long hair; ear short; tympanic bulla of moderate size. In the northern part of its range *S. nuttallii* occurs principally in the sagebrush areas but it occurs also in the timbered areas of the Transition Life-zone and almost exclusively in timbered areas in the southern part of its range. From *S. floridanus, S. nuttallii* along the eastern margin of its range differs in more slender rostrum, and larger external auditory meatus. In New Mexico and Arizona, *S. nuttallii* differs from *S. floridanus* in the posteriorly pointed and un-notched supraoccipital shield and in the posterior extension of the supraorbital process, the tip of which projects free from the braincase or merely lies against the braincase instead of being firmly welded to the side of the skull. From *S. audubonii, S. nuttallii* differs in shorter ears, smaller tympanic bullae and smaller hind legs; *S. nuttallii* usually occurs at higher elevations, or where the two occur at approximately the same elevation *S. nuttallii* occurs in wooded or brushy areas and *S. audubonii* lives on the plains or in relatively open country. Eight females contained an average of 6.1 (4-8) embryos.

SYLVILAGUS NUTTALLII GRANGERI (J. A. Allen).

1895. *Lepus sylvaticus grangeri* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 7:264, August 21, type from Hill City, Black Hills, Pennington County, South Dakota.

1909. *Sylvilagus nuttalli grangeri,* Nelson, N. Amer. Fauna, 29:204, August 31.

1904. *Lepus l[aticinctus]. perplicatus* Elliott, Field Columb. Mus., publ. 87, zool. ser., 3:255, January 7, type from Hannopee [= Hannaupah] Canyon, Panamint Mts., Inyo County, California.

Marginal records.—Alberta: Steveville (Anderson, 1943:25). Saskatchewan (*ibid.*): Cypress Hills; Johnston Lake; Big Muddy Lake. North Da-

kota: Goodall (V. Bailey, 1927:137). South Dakota: Custer (Nelson, 1909:207). Wyoming: 2 mi. W Horse Creek P. O. (15935 KU); Sherman (Nelson, 1909:207). Colorado: Meeker (Warren, 1942:272). Utah (Nelson, 1909:207): Mt. Ellen; "Upper Kanab"; Panguitch. Nevada (Hall, 1946: 612): ¼ mi. W Utah-Nev. boundary, 38° 17′ N, 7300 ft.; S end Belted Range, 5 mi. NW Whiterock Spring, 7200 ft.; Chiatovich Creek, 7000 ft.; 2½ mi. E and 1 mi. S Grapevine Peak, 6700 ft.; Charleston Park, Kyle Cañon, 8000 ft. California (Orr, 1940:103): Johnson Canyon, 6500 ft.; nr. Woodfords, 5500 ft. Nevada (Hall, 1946:612): Calvada; Hardscrabble Canyon; Paradise Valley. Idaho (Davis, 1939:363): S. Fork Owyhee River, 12 mi. N Nevada line; Crane Creek, 15 mi. E Midvale; Lemhi. Montana: 4 mi. W Hamilton (Jellison, MS); 2 mi. N Moise Lake (*ibid.*). Alberta: Cardston (Anderson, 1947:105).

Sylvilagus nuttallii nuttallii (Bachman).

1837. *Lepus nuttallii* Bachman, Jour. Acad. Nat. Sci. Philadelphia, 7:345, type locality probably eastern Oregon near mouth of Malheur River.
1904. *Sylvilagus nuttallii*, Lyon, Smiths. Misc. Coll., 45:323, June 15.

Marginal records.—British Columbia: Anarchist Mtn., Osoyoos (Cowan, 1940:9). Washington: Kettle Falls (Dalquest, 1941:408). Idaho: Couer d' Alene (Rust, 1946:322); *Lewiston* (Davis, 1939:361); Fiddle Creek (*ibid.*). Nevada (Hall, 1946:612): 5800 ft., Quinn River Crossing; *½ mi. S Granite Cr., Granite Mts.; Smoke Creek, 9 mi. E California line;* 4½ mi. S Flanigan. California: Truckee (Orr, 1940:101); *Beckwith* (*ibid.*); Weed (Orr, 1940:100); Yreka (*ibid.*). Oregon (V. Bailey, 1936:107): near Ashland; Bend; The Dalles. Washington: Grand Dalles (Taylor and Shaw, 1929:29); Yakima Valley (*ibid.*); Douglas (Nelson, 1909:203).

Sylvilagus nuttallii pinetis (J. A. Allen).

1894. *Lepus sylvaticus pinetis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:348, December 7, type from White Mts., south of Mt. Ord, Apache County, Arizona, according to Warren (Mammals of Colorado, 1942: 270).
1909. *Sylvilagus nuttalli pinetis*, Nelson, N. Amer. Fauna, 29:207, August 31.

Marginal records.—Colorado (Nelson, 1909:210): Arkins; Golden; Greenhorn Mts. New Mexico: Sierra Grande (Nelson, 1909:211); Willis (*ibid.*); Zuni Mts. (V. Bailey, 1932:60). Arizona: type locality. Utah (Durrant, MS): 4½ mi. NW Bluff; Block Canyon, 19 mi. SE Moab, 5400 ft.; *5 mi. NE La Sal P. O., 8000 ft.*

Sylvilagus audubonii

Audubon Cottontail

Total length, 350-420; tail, 45-75; hind foot, 75-100; ear from notch (dry), 55-70; weight of *S. a. vallicola*, 7 ♂ 912 (835-988), 2 ♀ 1096, 1191 grams. Long hind legs, long ears, sparseness of hair on the ears, shortness of hair on the feet, prominent (upturned) supraorbital process of the skull and much inflated tympanic bullae are characters of this wide-spread species. Embryos in 19 Californian females averaged 3.6 (2-6) per female.

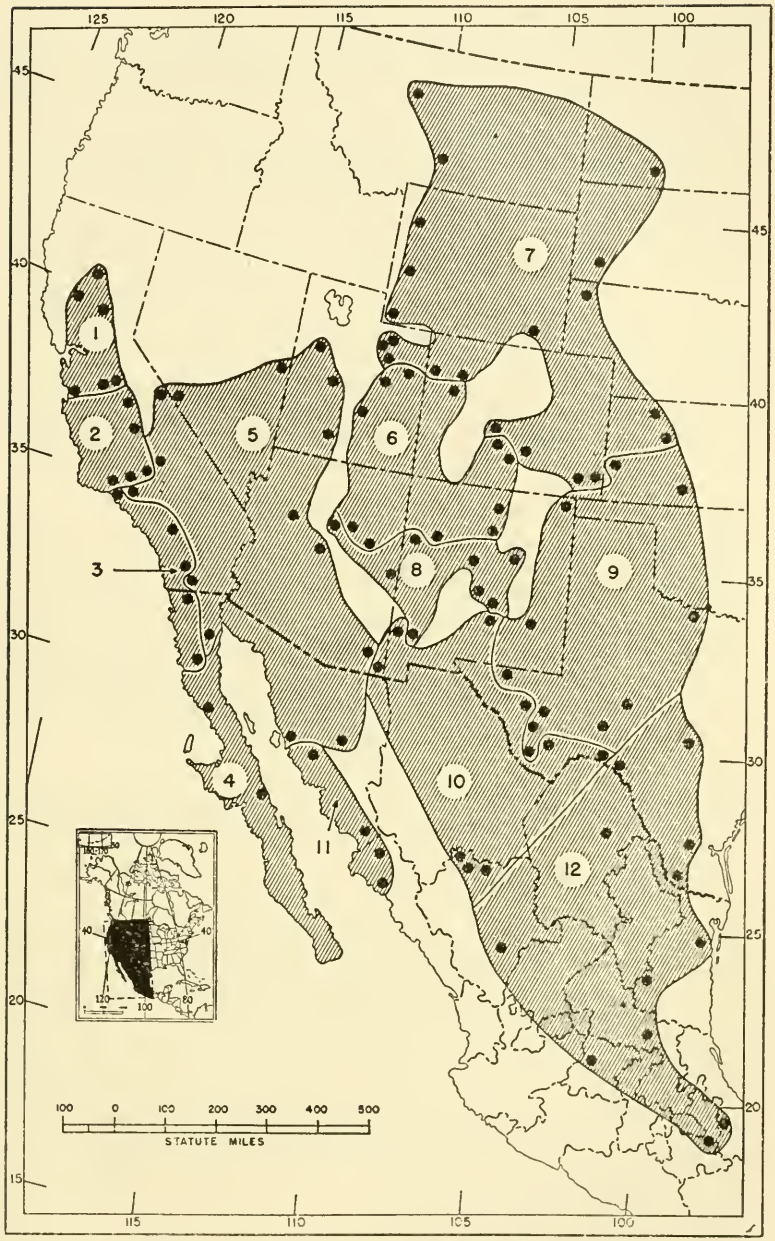


FIG. 41. Distribution of *Sylvilagus audubonii*.

1. *S. a audubonii*
2. *S. a. vallicola*
3. *S. a. sanctidiegi*
4. *S. a. confinis*
5. *S. a. arizonae*
6. *S. a. warreni*
7. *S. a. baileyi*
8. *S. a. cedrophilus*
9. *S. a. neomexicanus*
10. *S. a. minor*
11. *S. a. goldmani*
12. *S. a. parvulus*

Sylvilagus audubonii arizonae (J. A. Allen).

1877. [*Lepus sylvaticus*] var. *arizonae* J. A. Allen, Monogr. North Amer. Rodentia, p. 332, August, type from Beals Spring, Yavapai Co., Arizona.
1909. *Sylvilagus auduboni arizonae,* Nelson, N. Amer. Fauna, 29:222, August 31.
1896. *Lepus arizonae major* Mearns, Proc. U. S. Nat. Mus., 18:557, June 24, type from Calabasas, Pima County, Arizona.
1904. *Lepus laticinctus* Elliot, Field Columb. Mus., publ. 87, zool. ser., 3:254, January 7, type from Oro Grande, Mohave Desert, San Bernardino County, California.
1904. *Lepus l[aticinctus]. rufipes* Elliot, Field Columb. Mus., publ. 87, zool. ser., 3:254, January 7, type from Furnace Cr., Inyo Co., California.

Marginal records.—Utah (Durrant, MS): 2 mi. SW Fish Springs; Holden; 7 mi. SW Tropic. Arizona (Nelson, 1909:225): Seligman; Ft. Verde; Dos Cabesos. Sonora (Burt, 1938:69): Tecoripa; La Libertad Ranch. Baja California: San Matias Pass (Nelson, 1909:225). California: Vallecito (Orr, 1940:126); Fairmont, Antelope Valley (*ibid.*); Little Lake, 3300 ft. (Orr, 1940:125); 5300-5639 ft., near Benton (*ibid.*). Nevada (Hall, 1946: 614): Arlemont; 4 mi. E Smith Creek Cave.

Sylvilagus audubonii audubonii (Baird).

1858. *Lepus audubonii* Baird, Mamm. N. Amer., p. 608, July 14, type from San Francisco, San Francisco County, California.
1909. *Sylvilagus auduboni,* Nelson, N. Amer. Fauna, 29:214, August 31.

Marginal records (Orr, 1940:115).—California: 600 ft., Paines Creek; Rackerby; Pleasant Valley; Snelling; 2 mi. S mouth Salinas River, northward not reaching coast again except at San Francisco, thence around shores of San Francisco Bay to mouth of Carquinez Straits and northward along western side of Sacramento Valley to Winslow, 5 mi. W Fruto.

Sylvilagus audubonii baileyi (Merriam).

1897. *Lepus baileyi* Merriam, Proc. Biol. Soc. Washington, 11:148, June 9, type from Spring Creek, east side of Bighorn Basin, Bighorn County, Wyoming.
1908. *Sylvilagus auduboni baileyi,* Lantz, Trans. Kansas Acad. Sci., 22: 336.

Marginal records.—Montana: Great Falls of the Missouri (Nelson, 1909: 234). North Dakota: Wade on the Cannonball River (V. Bailey, 1927: 138). South Dakota: Corral Draw (Nelson, 1909:234). Nebraska: Glen (*ibid.*). Kansas: 12½ mi. S and 4 mi. W Oberlin (19035 KU); Wakeeney (1203 KU). Colorado (Nelson, 1909:234): Monon; The Cedars; Quenda [=Querida]; Salida. Wyoming: ½ mi. W Horse Creek P. O. (15948 KU). Colorado (Nelson, 1909:234): White Rock [2 mi. above Meeker, 6400 ft.]; 20 mi. SW Rangely. Utah (Durrant, MS): 8 mi. S Myton; 6 mi. NW Duchesne; 10 mi. E Mountain Home. Wyoming (Nelson, 1909:234): Ft. Bridger; Big Piney; Circle. Montana: Stillwater (*ibid.*). Phillips Creek, Montana (Nelson 1909:234) not found.

Sylvilagus audubonii cedrophilus Nelson.

1907. *Sylvilagus auduboni cedrophilus* Nelson, Proc. Biol. Soc. Washington, 20:83, July 22, type from Cactus Flat, 20 mi. N Cliff, Grant County, New Mexico.

Marginal records (Nelson, 1909:230).—Arizona: San Francisco Mts. New Mexico: Gallup; Santa Rosa; Capitan; Ancho; Isleta; Burro Mts. Arizona: Springerville.

SYLVILAGUS AUDUBONII CONFINIS (J. A. Allen).

1898. *Lepus arizonae confinis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10: 146, April 12, type from Playa Maria, Baja California.
1909. *Sylvilagus auduboni confinis,* Nelson, N. Amer. Fauna, 29:220, August 31.

Marginal records (Nelson, 1909:221).—Baja California: type locality; San Bruno, thence southerly over peninsula to tip.

SYLVILAGUS AUDUBONII GOLDMANI (Nelson).

1904. *Lepus arizonae goldmani* Nelson, Proc. Biol. Soc. Washington, 17: 107, May 18, type from Culiacán, Sinaloa.
1909. *Sylvilagus auduboni goldmani* Nelson, N. Amer. Fauna, 29:225, August 31.

Marginal records (Nelson, 1909:226).—Sonora: Ortiz; Camoa. Sinaloa: Bacubirito; type locality.

SYLVILAGUS AUDUBONII MINOR (Mearns).

1896. *Lepus arizonae minor* Mearns, Proc. U. S. Nat. Mus., 18:557, June 24, type from El Paso, El Paso County, Texas.
1907. *S[ylvilagus]. a[uduboni]. minor,* Nelson, Proc. Biol. Soc. Washington, 20:83, July 22.

Marginal records (Nelson, 1909:228, unless otherwise noted).—New Mexico: [12 mi. N] Tularosa. Texas: Kent; Haymond; Langtry. Durango (Nelson, 1909:229): Inde; Rancho Bailon; Río Campo. Arizona: San Bernardino Ranch. New Mexico: Red Rock; *Lordsburg.*

SYLVILAGUS AUDUBONII NEOMEXICANUS Nelson.

1907. *Sylvilagus auduboni neomexicanus* Nelson, Proc. Biol. Soc. Washington, 20:83, July 22, type from Fort Sumner, Guadalupe County, New Mexico.

Marginal records.—Kansas: 1 mi. E Coolidge (12976 KU); Rezeau Ranch, 5 mi. N Belvidere (13208 KU). Texas: Wichita Falls (Nelson, 1909: 236); San Angelo (*ibid.*); Adam [=15 mi. E Adams] (Nelson, 1909:236); 28 mi. S Alpine (Borell and Bryant, 1942:39); *15 mi. S Alpine,* (Hall and Kelson, 1951:57); 7 mi. NE Marfa (Blair, 1940:34); Toyahvale [= 10 mi. S of] (Nelson, 1909:236); McKittrick Canyon (Davis and Robertson, 1944: 271). New Mexico: Roswell (V. Bailey, 1932:54); Emory Peak (*ibid.*).

SYLVILAGUS AUDUBONII PARVULUS (J. A. Allen).

1904. *Lepus (Sylvilagus) parvulus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 20:34, February 29, type from Apam, Hidalgo.
1909. *Sylvilagus auduboni parvulus,* Nelson, N. Amer. Fauna, 29:236, August 31.

Marginal records (Nelson, 1909:237, unless otherwise noted).—Texas: Llano; San Diego; Rio Grande City. Tamaulipas: El Mulato (Dice, 1937: 256); Miquihuana. San Luis Potosí: Rio Verde. Veracruz: Perote. Puebla: Chalchicomula. Guanajuato: Silao. Durango: Durango City. Coahuila: Monclova. Texas: Comstock.

Sylvilagus audubonii sanctidiegi (Miller).

1899. *Lepus floridanus sanctidiegi* Miller, Proc. Acad. Nat. Sci. Philadelphia, 51:389, October 5, type from Mexican Boundary Monument No. 258, shore of Pacific Ocean, San Diego County, California.
1909. *Sylvilagus auduboni sanctidiegi*, Nelson, N. Amer. Fauna, 29:218, August 31.

Marginal records.—California (Orr, 1940:122): Sespe; Reche Canyon near Colton; San Felipe Canyon. Baja California (Nelson, 1909:220): Nachogüero Valley; Santo Tomas, thence northerly along coast.

Sylvilagus audubonii vallicola Nelson.

1907. *Sylvilagus auduboni vallicola* Nelson, Proc. Biol. Soc. Washington, 20:82, July 22, type from San Emigdio Ranch, Kern County, California.

Marginal records (Orr, 1940:118, unless otherwise noted).—California: Fresno Flat (Nelson, 1909:218); Badger (*ibid.*); 2750 ft., Onyx; Tehachapi (Nelson, 1909:218); Mt. Pinos (Orr, 1940:119), northwesterly, seldom actually reaching coast, to central Monterey County thence easterly to point of beginning.

Sylvilagus audubonii warreni Nelson.

1907. *Sylvilagus aububoni warreni* Nelson, Proc. Biol. Soc. Washington, 20:83, July 22, type from Coventry, Montrose County, Colorado.

Marginal records.—Utah: 5250 ft., Willow Creek (Durrant, MS). Colorado (Nelson, 1909:232): Rifle; Villa Grove; Medano Ranch. New Mexico: Hondo Canyon (Nelson, 1909:232); Cieneguilla (*ibid.*); Juan Tafoya (Bailey, 1932:59). Arizona (Nelson, 1909:232): Holbrook; Winslow. Utah: Canesville (*sic*) (Nelson, 1909:232); Wellington (Durrant, MS).

Sylvilagus aquaticus

Swamp Rabbit

Total length, 530-540; tail, 67-71; hind foot, 105-110; length of ear from notch (dry), 63-67. Upper parts blackish brown or reddish brown; underparts with some white; under side of tail white; skull robust; posterior extensions of supraorbital processes joined for their entire length with side of braincase or, in some specimens, with a small foramen between the braincase and the base of the posterior extension of the supraorbital process. This big rabbit is a stronger runner than the smaller marsh rabbit and is easily distinguished from the smaller species by larger size and white, instead of brownish or grayish, underside of the tail.

Sylvilagus aquaticus aquaticus (Bachman).

1837. *Lepus aquaticus* Bachman, Jour. Acad. Nat. Sci. Philadelphia, 7:319, type locality western Alabama.
1909. *Sylvilagus aquaticus*, Nelson, N. Amer. Fauna, 29:270, August 31.
1895. *Lepus aquaticus attwateri* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 7:327, November 8, type from Medina River, 18 mi. S San Antonio, Bexar County, Texas.
1899. *Lepus telmalemonus* Elliot, Field Columb. Mus., publ. 38, zool. ser., 1:285, May 25, type from Washita River, near Dougherty, Murray County, Oklahoma.

Marginal records.—Illinois: 6 mi. N Sesser (Cockrum, 1949:427). Indiana: Point Township (Harrison and Hickie, 1931:319). Tennessee: 5 mi. W Hornbeak (Kellogg, 1939:292); Henryville (A. H. Howell, 1909: 63). Alabama: Huntsville (Nelson, 1909:273); Big Crow Creek near Stevenson (A. H. Howell, 1921:71). South Carolina: "about" 3 mi. SE Westminster (F. Sherman, 1939:259); "about" 5 mi. W Iva (*ibid.*). Georgia: Fulton County (*ibid.*); Lumpkin (Nelson, 1909:273). Alabama: Castleberry (*ibid.*). Louisiana: Covington (Lowery, 1936:32); Kleinpeter (*ibid.*). Texas (Nelson, 1909:273): Sourlake; Richmond; Medina River, 18 mi. SW San Antonio; Gurley. Oklahoma: 7 mi. NW Stillwater (Blair, 1939:129). Kansas: Crawford County (8826 KU). Arkansas:

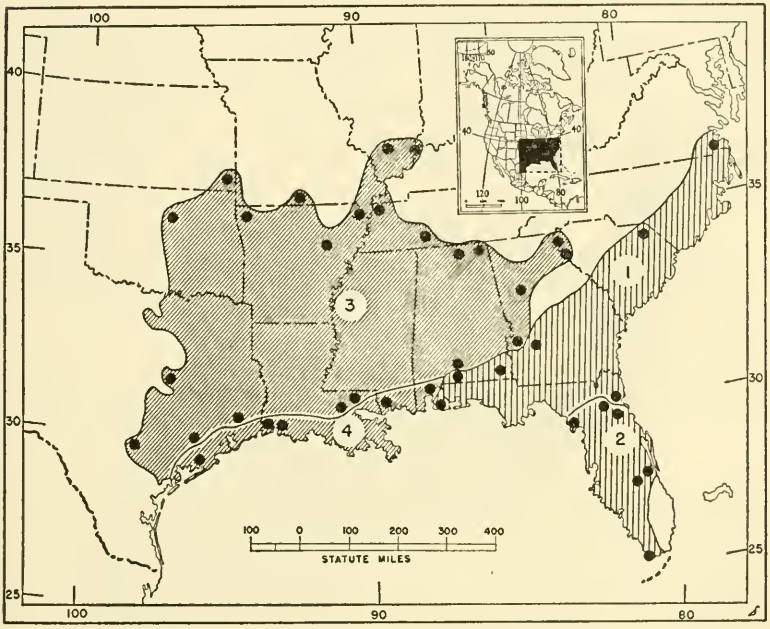


FIG. 42. Distribution of *Sylvilagus palustris* and *Sylvilagus aquaticus.*

1. *S. p. palustris*
2. *S. p. paludicola*
3. *S. a. aquaticus*
4. *S. a. littoralis*

along White River near Springdale (Black, 1936:34). Missouri: 3 mi. SW Udall (Leopold and Hall, 1945:145). Arkansas: White River near Augusta (Dellinger and Black, 1940:190). Missouri: St. Francis River, W of Senath (Nelson, 1909:273).

SYLVILAGUS AQUATICUS LITTORALIS Nelson.

1909. *Sylvilagus aquaticus littoralis* Nelson, N. Amer. Fauna, 29:273, August 31, type from Houma, Terrebonne Parish, Louisiana.

Range.—Swamps and marshes along Gulf Coast, wholly within Lower Austral Life-zone, below 50 ft., from Mobile Bay west to Matagordo Bay. Inland *Marginal records.*—Alabama: Blakely Island opposite Mobile (A. H.

Howell, 1921:73). Mississippi: Bay St. Louis (Nelson, 1909:275). Louisiana: Rayne (Lowery, 1936:32); Hackberry (Nelson, 1909:275). Texas: Matagorda (Nelson, 1909:275).

Sylvilagus insonus (Nelson)

Omilteme Cottontail

(See figure 39)

1904. *Lepus insonus* Nelson, Proc. Biol. Soc. Washington, 17:103, May 18, type from Omilteme, Guerrero. Known from type locality only.

1909. *Sylvilagus insonus*, Lyon and Osgood, Bull. U. S. Nat. Mus., 62:34, January 28 (see Hershkovitz, Proc. U. S. Nat. Mus., 100:335, May 26, 1950, for allocation of *S. insonus* to subgenus *Sylvilagus* instead of to subgenus *Tapeti*).

FIG. 43. Distribution of *Sylvilagus cunicularius* and *Sylvilagus graysoni*.

1. *Sylvilagus cunicularius insolitus*
2. *Sylvilagus cunicularius pacificus*
3. *Sylvilagus cunicularius cunicularius*
4. *Sylvilagus graysoni*

Total length, 435; tail, 42.5; hind foot, 95; ear from notch (dry), 61. Color grayish brown above and dingy (not white) below; tail dingy buffy below and dull rusty brown above. The collectors thought that the species was restricted to the forested parts of the Sierra Madre del Sur between 7000 and 10,000 feet altitude in the Mexican state of Guerrero.

Sylvilagus cunicularius

Mexican Cottontail

Total length, 485-515; tail, 54-68; hind foot, 108-111; ear from notch (dry), 60-63. Pelage coarse; upper parts brownish gray; skull massive; posterior extensions of supraorbital processes varying from those that project free to those that have the tips, or tips and a considerable part of the processes, attached to the braincase.

SYLVILAGUS CUNICULARIUS CUNICULARIUS (Waterhouse).

1848. *Lepus cunicularius* Waterhouse, Nat. Hist. Mammalia, 2:132, type from Zacualpan (probably in state of México).
1909. *Sylvilagus cunicularius*, Nelson, N. Amer. Fauna, 29:239, August 31.
1890. *Lepus verae-crucis* Thomas, Proc. Zool. Soc. London, p. 74, June, type from Las Vigas, Veracruz.

Marginal records (Nelson, 1909:241).—Hidalgo: Tulancingo. Veracruz: Las Vigas; Orizaba. Oaxaca: Mt. Zempoaltepec; Suchixtepec. Guerrero: Chilpancingo. Michoacán (Hall and Villa, 1949:469). Pátzcuaro; Tancítaro.

SYLVILAGUS CUNICULARIUS INSOLITUS (J. A. Allen).

1890. *Lepus insolitus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:189, December 10, type from plains of Colima, Jalisco.
1909. *Sylvilagus cunicularius insolitus*, Nelson, N. Amer. Fauna, 29:243, August 31.

Marginal records (Nelson, 1909:244).—Sinaloa: Mazatlan; Rosario; Esquinapa. Nayarit: Acaponeta. Colima: Colima; Armeria, thence northward along Pacific Coast.

SYLVILAGUS CUNICULARIUS PACIFICUS (Nelson).

1904. *Lepus veraecrucis pacificus* Nelson, Proc. Biol. Soc. Washington, 17: 104, May 18, type from Acapulco, Guerrero.
1909. *Sylvilagus cunicularius pacificus*, Lyon and Osgood, Catal. Bull. U. S. Nat. Mus., 62:35, January 28.

Marginal records (Nelson, 1909:242).—Guerrero: El Limón. Oaxaca: Llano Grande, thence westward along Pacific Coast.

Sylvilagus graysoni (J. A. Allen)

Tres Marias Cottontail

1877. *Lepus graysoni* J. A. Allen, Monogr. N. Amer. Rodentia, p. 347, August, type from Tres Marias Islands, Jalisco; probably María Madre Island. (See Nelson, N. Amer. Fauna, 14:16, April 29, 1899.)
1904. *Sylvilagus (Sylvilagus) graysoni*, Lyon, Smiths. Misc. Coll., 45:336, June 15.

Marginal records (Nelson, 1909:245): María Madre Island; María Magdalena Island.

Total length, 480; tail, 51; hind foot, 99; ear from notch (dry), 57. This insular species is closely related to *Sylvilagus cunicularius* of the adjacent mainland but has notably shorter ears and more reddish on the upper parts, sides and legs; the skull is slenderer, es-

pecially in the rostral region. The posterior extensions of the supraorbital process are united to the braincase throughout most of their length as in *Sylvilagus palustris*. The species seems to have a narrow vertical range, occurring from sea level up to only 200 feet.

Genus Lepus Linnaeus—Hares and Jack Rabbits

Revised by Nelson, N. Amer. Fauna, 29:59-158, August 31, 1909. Concerning Shamel's (Proc. Biol. Soc. Washington, 55:25, May 12, 1942) proposed changes of names for several species, see Hall, Univ. Kansas Publ., Mus. Nat. Hist., 5:45, October 1, 1951.

1758. *Lepus* Linnaeus, Systema Naturae, ed. 10, 1:57. Type *Lepus timidus* Linnaeus.
1895. *Macrotolagus* Mearns, Science, n. s., 1:698, June 21. Type, *Lepus alleni* Mearns. (See Mearns, Proc. U. S. Nat. Mus., 18:552, June 24, 1896.)
1904. *Poecilolagus* Lyon, Smiths. Misc. Coll., 45:395, June 15. Type, *Lepus americanus* Erxleben.
1904. *Lagos* Palmer. N. Amer. Fauna, 23:361, January 23. Type, *Lepus arcticus* Ross. *Lagos* J. Brooks, a catalogue of the anatomical and zoological museum, pt. 1, p. 54, July, 1828, appears to be a *nomen nudum*.
1911. *Boreolepus* Barrett-Hamilton, History of the British Mammalia, pt. 9, p. 160, November 17. Type, *Lepus groenlandicus* Rhoads. (For status see Sutton and Hamilton, Mem. Carnegie Mus., 12(pt. 2, sec. 1): 78, August 4, 1932; also A. H. Howell, Jour. Mamm., 17:331, November 16.)

Total length, 363-664; tail, 25-112; hind foot, 112-189; ear from notch (dry), 62-144. Upper parts grayish, brownish or black; interparietal bone fused to surrounding bones; cervical vertabrae long, 2nd and 3rd being longer than wide; transverse processes of lumbar vertabrae long, the longest one equal to the length of the centrum to which it is attached plus half of the length of the preceding centrum; free extremity of transverse process of lumbar vertebra considerably expanded; distance from anterior edge of acetabulum to extreme anterior point of ilium less than distance from former point to most distant point of ischium; ulna reduced in size along middle part of shaft, and, excepting the lower extremity, placed almost entirely behind radius.

All members of the genus *Lepus* are technically hares, as these are defined in the account of the family Leporidae. The largest members of the order Lagomorpha are members of the genus *Lepus*. No domestic strains have been developed but effort in this direction might be profitable, in as much as the so-called Belgian hares of the related genus, *Oryctolagus*, have done well in captivity.

In the past it has been customary to recognize two or more subgenera of the genus *Lepus*. The species are a less diverse lot than

those in some other genera, however, and it seems that no useful purpose is served by recognizing subgenera. Accordingly, the several names proposed for this purpose are arranged here as synonyms of the generic name *Lepus* Linnaeus.

The introduction of the European Hare (*Lepus europaeus*) into the eastern part of the North American Continent has been successful in the sense that the animal is multiplying. If it continues to increase, the increase almost certainly will be at the expense of some native species of rabbit. This circumstance and the unfortunate consequences of the introduction of the European rabbit (*Oryctolagus cuniculus*) in New Zealand (see Wodzicki, 1950:107-141) and Australia (see Stead, 1925:355-358) give basis for effort to exterminate the alien species before it spreads more widely.

KEY TO THE SPECIES OF THE GENUS LEPUS

1. North of 34° N latitude.
   2. All white pelage (tips of ears sometimes black).
      3. North of line from Port Simpson, British Columbia, to Halifax, Nova Scotia.
         4. Basilar length of skull more than 67; ear from notch usually more than 73 dry (77 fresh); first upper incisors inscribing an arch of a circle the radius of which is more than 9.6 mm.
            5. Geographic range east of Mackenzie River.
               Lepus arcticus, p. 178
            5′. Geographic range west of Mackenzie River.
               Lepus othus, p. 177
         4′. Basilar length of skull less than 67; ear from notch usually less than 73 dry (77 fresh); first upper incisors inscribing an arch of a circle the radius of which is less than 9.6 mm.
            Lepus americanus, p. 173
      3′. South of a line from Port Simpson, British Columbia to Halifax, Nova Scotia.
         5. Ear from notch more than 82 dry (87 fresh); least interorbital breadth more than 26..... *Lepus townsendii*, p. 180
         5′. Ear from notch less than 82 dry (87 fresh); least interorbital breadth less than 26.....*Lepus americanus*, p. 173
   2′. Brownish or grayish pelage.
      6. Tail blackish or brownish all around (in specimens not having completed molt on tail, white winter pelage may be present); basilar length less than 67 mm.
         Lepus americanus, p. 173
      6′. Tail partly or wholly white.
         7. Tail black on upper surface.
            8. Upper sides of hind feet without a trace of white; upper parts tawny.
               Lepus europaeus, p. 189

8′. Upper sides of hind feet with more or less white or whitish; upper parts grayish or brownish..... *Lepus californicus*, p. 181

7′. Tail all white or (in some *Lepus townsendii*) with faint buffy or dusky median line on top but this line not extending on to rump (as in *L. californicus*).

9. Geographic range north of a line from Port Simpson, British Columbia, to Halifax, Nova Scotia.

10. Geographic range east of Mackenzie River ..... *Lepus arcticus*, p. 178

10′. Geographic range west of Mackenzie River ..... *Lepus othus*, p. 177

9′. Geographic range south of a line from Port Simpson, British Columbia, to Halifax, Nova Scotia..... *Lepus townsendii*, p. 180

1′. South of 34° N latitude.

11. In state of Tamaulipas, México. *Lepus californicus*, p. 181

11′. Range outside Tamaulipas, México.

12. Ears with terminal black patch (on outside). *Lepus californicus* and *Lepus insularis*, pp. 181, 186

12′. Ears without terminal black patch.

13. Ear from notch, dry more than 130 (137 fresh), *Lepus alleni*, p. 188

13′. Ear from notch, dry less than 130 (137 fresh).

14. Nape more or less black.

15. Ears yellow; range Pacific Coastal region of Isthmus of Tehuantepec in southern Oaxaca and Chiapas. *Lepus flavigularis*, p. 188

15′. Ears dark buff, grayish, white and black; range north of Isthmus of Tehuantepec. *Lepus callotis*, p. 186

14′. Nape gray or grayish buff. *Lepus gaillardi*, p. 188

Lepus americanus

American Varying Hare

Total length, 363-520; tail, 25-55; hind foot, 112-150; ear from notch (dry), 62-70. Upper parts brownish or dusky grayish; hind feet brownish or white depending on subspecies; winter pelage white except in certain populations along Pacific Coast; basilar length less than 67; first upper incisors inscribing an arc of a circle

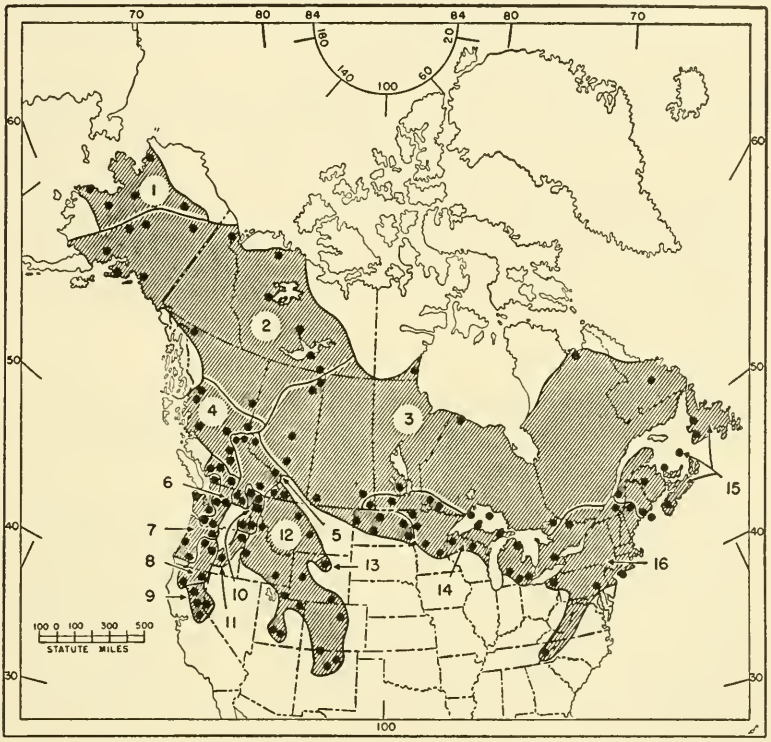


FIG. 44. Distribution of *Lepus americanus*.

Guide to subspecies:

1. *L. a. dalli*
2. *L. a. macfarlani*
3. *L. a. americanus*
4. *L. a. pallidus*
5. *L. a. columbiensis*
6. *L. a. cascadensis*
7. *L. a. washingtoni*
8. *L. a. klamathensis*
9. *L. a. tahoensis*
10. *L. a. pineus*
11. *L. a. oregonus*
12. *L. a. bairdii*
13. *L. a. seclusus*
14. *L. a. phaenotus*
15. *L. a. struthopus*
16. *L. a. virginianus*

the radius of which is less than 9.6 mm. There are two to six young in a litter according to Orr (1940:59).

Lepus americanus americanus Erxleben.

1777. [*Lepus*] *americanus* Erxleben, Systema Regni Animalis . . ., 1:330, type locality Hudson Bay, Canada.
1778. *Lepus hudsonius* Pallas, Glires, p. 30, type locality not stated.
1790. *Lepus nanus* Schreber, Säugethiere, 4:880-885, pl. 234B, a composite of *Lepus americanus* and *Sylvilagus floridanus*. No type or type locality designated. Range given as from Hudson Bay to Florida.
1899. *Lepus bishopi* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 12:11, March 4, type from Mill Lake, Turtle Mts., North Dakota (inseparable from *L. a. americanus* according to V. Bailey, N. Amer. Fauna, 49:138, January 8, 1927 [not December, 1926]).

Marginal records (Nelson, 1909:89, unless otherwise noted).—Keewatin: Hudson Bay (Anderson, 1947:100). Ontario: Fort Severn (Nelson, 1909: 88); around shore of Hudson Bay to approximately 56° N thence to Ungava: Fort Chimo. Labrador: Hamilton Inlet. Ontario: North Bay of Lake Nipissing; Michipicoten Island; Isle Royal (Anderson, 1947:100). Manitoba: Dog Lake. Saskatchewan: Indian Head. North Dakota (V. Bailey, 1927:139): Mill Lake, Turtle Mts.; Grafton; "near" Fargo; Elbowoods; Buford. Saskatchewan: Battle Creek (Soper, 1946:149). Alberta: Red Deer; 50 mi. N Edmonton; Fort Chipewyan; Govt. Hay Camp, Slave River (Soper, 1942:140).

Lepus americanus bairdii Hayden.

1869. *Lepus bairdii* Hayden, Amer. Nat., 3:115, May, type locality Columbia Valley, Wind River Mts., Fremont County, Wyoming.
1875. [*Lepus americanus*] var. *bairdii*, J. A. Allen, Proc. Boston Soc. Nat. Hist., 17:431, February 17.

Marginal records.—British Columbia: Elko (Anderson, 1947:100); Waterton Lakes Nat'l Park (*ibid.*). Montana (Nelson, 1909:112): Fort Benton; Big Snowy Mts. Wyoming: 5 mi. E and 9 mi. N Pinedale (15924 KU); 3 mi. ESE Browns Peak (17603 KU). Colorado: Boulder Co. (Nelson, 1909:112). New Mexico: 10,500 ft., Agua Fria Mtn. (Hill, 1942:82); Pecos Baldy (V. Bailey, 1932:45); Chama (*ibid.*). Utah (Durrant, MS unless otherwise noted): 18 mi. SE Manila; *30 mi. N Fort Duchesne; 23 mi. N Fruitland;* 21 mi. N Escalante; 10 mi. E Marysvale; City Creek Canyon, Salt Lake City (Barnes, 1927:145). Idaho (Dalquest, 1942:181): Pocatello; *Payette;* Cuddy Mtn.; *Weippe;* Bitterroot Valley. *British Columbia*: *Newgate* (Anderson, 1947:100).

Lepus americanus cascadensis Nelson.

1907. *Lepus bairdi cascadensis* Nelson, Proc. Biol. Soc. Washington, 20: 87, December 11, type from Roab's ranch, near Hope, British Columbia.
1935. *Lepus americanus cascadensis*, Racey and Cowan, Rep't Prov. Mus. British Columbia, 1935:H28.

Marginal records (Dalquest, 1942:177, unless otherwise noted).—British Columbia: type locality; Fairview-Keremeos Summit (Anderson, 1947: 101). Washington: Lake Chelan; Trout Lake; Vance; *Mt. Rainier;* Entiat River, 20 mi. from mouth. British Columbia: Alta Lake.

LEPUS AMERICANUS COLUMBIENSIS Rhoads.

1895. *Lepus americanus columbiensis* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, p. 242, July 2, type from Vernon, British Columbia.

Marginal records.—Alberta: Banff Nat'l Park (Anderson, 1947:101); Jasper Nat'l Park (*ibid.*). British Columbia: Creston (Dalquest, 1942:182). Washington: Republic (Dalquest, 1948:385); Moulson (Dalquest, 1942: 182). British Columbia: Cottonwood Post Office (Dalquest, 1942:182); Indianpoint Lake (*ibid.*).

LEPUS AMERICANUS DALLI Merriam.

1900. *Lepus americanus dalli* Merriam, Proc. Washington Acad. Sci., 2:29, March 14, type from Nulato, Alaska.

Marginal records:—Noatak River (Bailey and Hendee, 1926:21); Upper St. John River (Rausch, 1950:466); Koyukuk (Nelson, 1909:102); Anvik (*ibid.*); Yukon Delta (*ibid.*); thence northerly, in suitable habitat, along coast to Noatak River.

LEPUS AMERICANUS KLAMATHENSIS Merriam.

1899. *Lepus klamathensis* Merriam, N. Amer. Fauna, 16:100, October 28, type from head of Wood River, near Fort Klamath, Klamath County, Oregon.
1936. *Lepus americanus klamathensis*, V. Bailey, N. Amer. Fauna, 55:95, August 29.

Marginal records.—Oregon (Dalquest, 1942:176): Mt. Hood; mouth Davis Creek. California (Orr, 1940:53): vicinity Fort Bidwell; 3000 ft., Rush Creek, 12 mi. from [N of] Weaverville. *Oregon: Estacada* (Dalquest, 1942:176).

LEPUS AMERICANUS MACFARLANI Merriam.

1900. *Lepus americanus macfarlani* Merriam, Proc. Washington Acad. Sci., 2:30, March 14, type from Fort Anderson, near mouth of Anderson River, Mackenzie.
1900. *Lepus saliens* Osgood, N. Amer. Fauna, 19:39, October 6, type from Caribou Crossing, between Lake Bennett and Lake Tagish, Yukon.
1907. ? *Lepus niediecki* Matschie, Niedieck's Kreuzfahrten im Beringmeer, p. 240, type locality Kasilof Lake, Kenai Peninsula, Alaska.

Marginal records (Nelson, 1909:100, unless otherwise noted).—Mackenzie: type locality; Fort Franklin; Fort Rae; Fort Resolution; Fort Smith. British Columbia: Peace River and Alaska Highway (Anderson, 1947:101); Bennett. Alaska: Cordova (Philip, 1939:84); Mills Creek (*ibid.*); Lake Clark; E. Fork Kuskokwim River (Dice, 1921:27); head N. Fork Kuskokwim (*ibid.*); Fort Yukon. Yukon: Russell Mts.

LEPUS AMERICANUS OREGONUS Orr.

1934. *Lepus bairdii oregonus* Orr, Jour. Mamm., 15:152, May 15, type from 12 mi. S Canyon City, 5500 ft., Grant County, Oregon.
1942. *Lepus americanus oregonus*, Dalquest, Jour. Mamm., 23:179, June 3.

Marginal records.—Oregon (Dalquest, 1942:180): 22 mi. N Enterprise; *Wallowa Lake; summit of Blue Mts.;* Ochoco Nat'l Forest, Harney County.
1938. *Lepus americanus pallidus* Cowan, Jour. Mamm., 19:242, May 12, type from Chezacut Lake, Chiloctin River, British Columbia.

Lepus americanus pallidus Cowan.

Marginal records.—British Columbia: 23 mi. N Hazelton (Dalquest, 1942: 183); Berg Lake (*ibid.*); Quesnel (Cowan, 1938:243); Lac La Hache (*ibid.*); Bonaparte River, 5 days N Ashcroft (Dalquest, 1942:183); Kimsquit, Dean Channel (Anderson, 1947:102); Hazelton (Dalquest, 1942: 183).

Lepus americanus phaeonotus J. A. Allen.

1899. *Lepus americanus phaeonotus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 12:11, March 4, type from Hallock, Kittson County, Minnesota.

Marginal records (Nelson, 1909:96, unless otherwise noted).—Manitoba: Selkirk Settlement. Ontario: Lake of the Woods (Anderson, 1947:102); Rainy Lake. Michigan: Houghton; Chippewa County (Burt, 1946:244); Presque Isle County (*ibid.*); Wayne County (*ibid.*); Jackson County *ibid.*); Allegan County (*ibid.*). Wisconsin: Rhinelander; St. Croix River, Douglas Co. Minnesota: Elk River; Moores Lake; Warren; St. Vincent. Saskatchewan: Glen Ewen (Soper, 1946:149). Manitoba: Carberry (Anderson, 1947:102).

Lepus americanus pineus Dalquest.

1942. *Lepus americanus pineus* Dalquest, Jour. Mamm., 23:178, June 3, type from Cedar Mtn., Latah County, Idaho.

Marginal records.—British Columbia (Anderson, 1947:102): Trail; Nelson Range south of Creston. Idaho (Dalquest, 1942:179): 5 mi. W Cocolalla; Troy. Washington (Dalquest, 1942:179): Blue Mts., Columbia County; *Marcus. British Columbia*: *Rossland* (Anderson, 1947:102).

Lepus americanus seclusus Baker and Hankins.

1950. *Lepus americanus seclusus* Baker and Hankins, Proc. Biol. Soc. Washington, 63:63, May 25, type from 12 mi. E and 2 mi. N Shell, 7900 ft., Bighorn Mts., Big Horn County, Wyoming. Type locality is only precise locality.

Lepus americanus struthopus Bangs.

1898. *Lepus americanus struthopus* Bangs, Proc. Biol. Soc. Washington, 12:81, March 24, type from Digby, Nova Scotia.

Marginal records (Nelson, 1909:92, unless otherwise noted).—Newfoundland (introduced in 1864): Bay of Islands; Bay of St. George. Nova Scotia: type locality. Maine: Bucksport. Quebec: south of St. Lawrence River (Anderson, 1947:102). New Brunswick: Andover. Prince Edward Island: Alberton. Quebec: Grosse Isle, Magdalen Islands.

Lepus americanus tahoensis Orr.

1933. *Lepus washingtonii tahoensis* Orr, Jour. Mamm., 14:54, February 14, type from ½ mi. S Tahoe Tavern, Placer County, California.
1942. [*Lepus americanus*] *tahoensis*, Dalquest, Jour. Mamm., 23:176, June 3.

Marginal records.—California: vic. Mineral (Orr, 1940:56). Nevada: 350 yards NE junction of Nevada state line and N shore Lake Tahoe (Hall, 1946:601). California: Niagara Creek (Orr, 1940:55); Cisco (Orr, 1940: 56).

LEPUS AMERICANUS VIRGINIANUS Harlan.

1825. *Lepus virginianus* Harlan, Fauna Americana, p. 196, type locality Blue Mountains, northeast of Harrisburg, Pennsylvania.
1875. *Lepus americanus* var. *virginianus*, J. A. Allen, Proc. Boston Soc. Nat. Hist., 17:431, February 17.
1825. *Lepus wardii* Schinz, Das Thierreich . . ., 4:428, based on the varying hare of the southern part of the United States (Warden, D. B., in A statistical, political, and historical account of the United States of North America . . ., 1:233, 1819).
1845. *Lepus borealis* Schinz, Synopsis Mammalium, 2:286-287. No type or type locality mentioned. From Virginia and the Alleghenies.

Marginal records (Nelson, 1909:94, unless otherwise noted).—Quebec (Anderson, 1947:103): Ottawa River; Megantic County. Maine: *Greenville* (Nelson, 1909:95); Sebec Lake (*ibid.*); Mt. Desert Island (Manville, 1942: 397). *Massachusetts: Concord; Middleboro. Rhode Island: Washington County.* New York: Locust Grove. Pennsylvania: type locality. Tennessee: White Rock (Kellogg, 1939:289). Ohio: Ashtabula Co. (Bole and Moulthrop, 1942:174). Ontario: Holland Riv. (Snyder and Logier, 1930:180).

LEPUS AMERICANUS WASHINGTONII Baird.

1855. *Lepus washingtonii* Baird, Proc. Acad. Nat. Sci. Philadelphia, 7:333, type from Steilacoom, Washington.
1875. *Lepus americanus* var. *washingtoni*, J. A. Allen, Proc. Boston Soc. Nat. Hist., 18:431, February 17.

Marginal records (Dalquest, 1942:175, unless otherwise noted).—British Columbia (Nelson, 1909:107): Sumas; Chilliwack. Washington: *Mt. Vernon;* Lake Kapowsin; White Salmon. Oregon: Drew; Florence; *Tillamook.* Washington: Sekiu River.

Lepus othus

Alaskan Hare

Total length, 565-690; tail, 53-104; hind foot, 147-189; ear from notch (dry), 75-78. Color brownish in summer; white in winter; but tips of ears always black. General comparisons indicate that this is the species which, in Eurasia, bears the name *Lepus timidus.*

LEPUS OTHUS OTHUS Merriam.

1900. *Lepus othus* Merriam, Proc. Washington Acad. Sci., 2:28, March 14, type from St. Michael, Norton Sound, Alaska.

Marginal records.—Alaska (A. H. Howell, 1936:334): Kotzebue Sound; mts. NW Nulato River; Akiak; 75 mi. below Bethel; thence N along coast.

LEPUS OTHUS POADROMUS Merriam.

1900. *Lepus poadromus* Merriam, Proc. Washington Acad. Sci., 2:29, March 14, type from Stepovak Bay, Alaska Peninsula, Alaska.
1936. *Lepus othus poadromus*, A. H. Howell, Jour. Mamm., 17:334, November 16.

Marginal records.—Alaska (A. H. Howell, 1936:335): Nushagak; Kawatna Bay, Shelikof Strait; *Cold Bay; Chignik; type locality; Sand Point;* 15 mi. W Pavlof Mtn.

Lepus arcticus

Arctic Hare

Revised by A. H. Howell, Jour. Mamm., 17:315-332, November 16, 1936. For the taxonomic status of the technical names *arcticus* and *glacialis* see Rhoads, Amer. Nat., 30:234-235, March, 1896; Merriam, Science, n. s., 3:564-565, April 10, 1896; Rhoads, Science, n. s., 3:843-845, June 5, 1896; Merriam, Science, n. s., 3:845, June 5, 1896.

Total length, 480-678; tail, 34-80; hind foot, 132-174; ear from notch (dry), 70-84. Upper parts gray in summer in southern subspecies; in others white; in winter white in all subspecies, except black tips of ears. Weights of lean individuals reach 12 pounds. Hopping on the hind feet without touching the forefeet to the ground has repeatedly been recorded for this species. There are four to eight young in a litter.

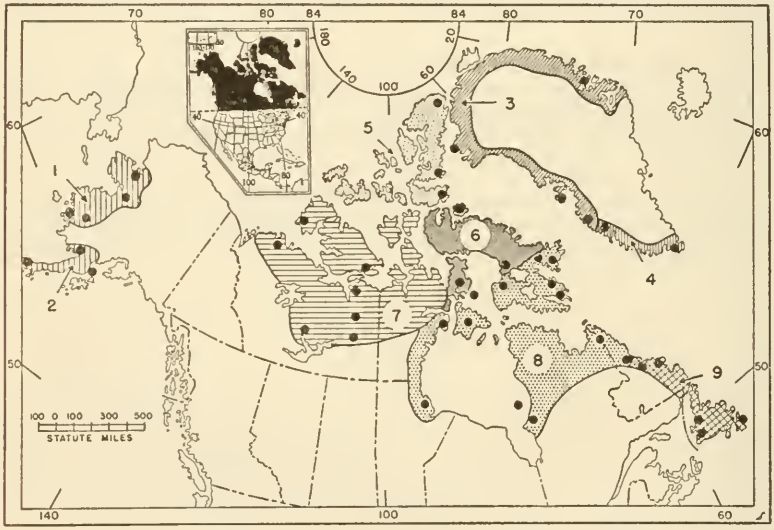


FIG. 45. Distribution of *Lepus othus* and *Lepus arcticus*.

1. *L. o. othus*
2. *L. o. poadromus*
3. *L. a. groenlandicus*
4. *L. a. porsildi*
5. *L. a. monstrabilis*
6. *L. a. arcticus*
7. *L. a. andersoni*
8. *L. a. labradorius*
9. *L. a. bangsi*

LEPUS ARCTICUS ARCTICUS Ross.

1819. *Lepus arcticus* Ross, Voyage of Discovery, ed. 2, vol. 2, appendix 4, p. 151, type locality Possession Bay, Bylot Island, lat. 73° 37′ N.
1819. *Lepus glacialis* Leach, in Ross, Voyage of Discovery, ed. 2, vol. 2, p. 170, type locality same as for *Lepus arcticus* Ross.

Marginal records.—Franklin: type locality; Egukjuak, 8 mi. E Pond Inlet, Baffin Island (A. H. Howell, 1936:322); W coast Baffin Island, 67° 30′ (Anderson, 1947:96); Winter Island, Melville Peninsula (A. H. Howell, 1936:321); Repulse Bay, Melville Peninsula (*ibid.*)

LEPUS ARCTICUS ANDERSONI Nelson.

1934. *Lepus arcticus andersoni* Nelson, Proc. Biol. Soc. Washington, 47:85, March 8, type from Cape Barrow, Coronation Gulf, Northwest Territory.

Marginal records (A. H. Howell, 1936:328). — Franklin: Cape Kellett, Banks Island; Cambridge Bay, Victoria Island. Mackenzie: Bathurst Inlet; Backs River near Lake Beechey; Lake Hanbury; Fort Rae; Fort Anderson.

LEPUS ARCTICUS BANGSII Rhoads.

1896. *Lepus arcticus bangsii* Rhoads, Amer. Nat., 30:253[= 236 of March issue], author's separates (preprints) published February 20, 1896, type from Codroy, Newfoundland.

Marginal records (A. H. Howell, 1936:327).—Labrador: Hopedale; Makkovik. Newfoundland: Saint Johns; type locality; Mt. St. Gregory.

LEPUS ARCTICUS GROENLANDICUS Rhoads.

1896. *Lepus groenlandicus* Rhoads, Amer. Nat., 30:254(= 237 of March issue), author's separates (preprints) issued February 20, type from Robertson Bay, NW Greenland.
1934. [*Lepus arcticus*] *groenlandicus,* Nelson, Proc. Biol. Soc. Washington, 47:83, March 8.
1912. *Boreolepus groenlandicus,* Barrett-Hamilton, Hist. British Mammals, pt. 12, p. 298, October.
1930. *Lepus variabilis hyperboreus* Pedersen, Medd. om Grönland, 77:363, no type or type locality designated but name applied to hares of east Greenland in the general vicinity of Scoresby Sound (preoccupied by *Lepus hyperboreas* Pallas, Zoogeographica Rosso Asiatica, 1:152, 1831, a species of *Ochotona*).
1934. *Lepus arcticus persimilis* Nelson, Proc. Biol. Soc. Washington, 47:84, March 8, type from S side Clavering Island, east Greenland.

Marginal records.—Greenland (A. H. Howell, 1936:331): Cape Alexander; on east coast to Francis Joseph Fiord; on west coast to *Nugsuak Peninsula*; Disko Island; Holsteinsborg.

LEPUS ARCTICUS LABRADORIUS Miller.

1899. *Lepus labradorius* Miller, Proc. Biol. Soc. Washington, 13:39, May 29, type from Fort Chimo, Ungava, Canada.
1924. *Lepus arcticus labradorius,* G. M. Allen and Copeland, Jour. Mamm., 5:12, February 9.
1902. *Lepus arcticus canus* Preble, N. Amer. Fauna, 22:59, October 31, type from Hubbart Point, W coast Hudson Bay, Keewatin.

Marginal records (A. H. Howell, 1936:323).—Franklin: Pangnirtung Fiord; Nunata, Kingua Fiord; Cumberland Sound, Blacklead Island; Weddell Harbor, Frobisher Bay. Labrador: Ramah; Solomons Island, near Davis Inlet. Quebec: *type locality;* Great Whale River, Hudson Bay; Belcher Islands. Manitoba: Fort Churchill; *Hubbart Point.* Keewatin: Cape Fullerton; Southampton Island. Franklin: *Cape Dorset;* Camp Kungovik, W coast Baffin Island, 65° 35′ N lat.; *Nettilling Fiord.*

LEPUS ARCTICUS MONSTRABILIS Nelson.

1934. *Lepus arcticus monstrabilis* Nelson, Proc. Biol. Soc. Washington, 47:85, March 8, type from Buchanan Bay, Ellesmere Island.

Marginal records.—Franklin (A. H. Howell, 1936:329): Cape Sheridan; Craig Harbor; Dundas Harbor, Devon Island.

LEPUS ARCTICUS PORSILDI Nelson.

1934. *Lepus arcticus porsildi* Nelson, Proc. Biol. Soc. Washington, 47:83, March 8, type from near Julianehaab, 61° 20′ N lat., Greenland.

Marginal records.—Greenland (A. H. Howell, 1936:332): Sukkertoppen; *Neria, 61° 36′ N lat.;* 60° 42′ N lat.

Lepus townsendii

White-tailed Jack Rabbit

Total length, 565-655; tail, 66-112; hind foot, 145-172; ear from notch (dry), 96-113. Upper parts grayish brown; tail all white or with dusky or buffy mid-dorsal stripe which does not extend

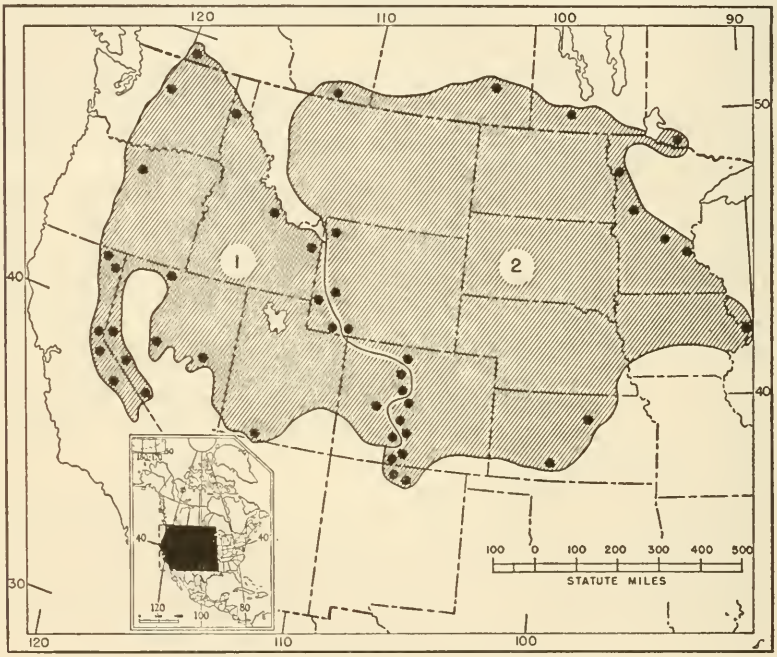


FIG. 46. Distribution of *Lepus townsendii.*

1. *Lepus townsendii townsendii* 2. *Lepus townsendii campanius*

onto back; white in winter in northern parts of its range. Two adult males weighed 2945 and 2494 grams (Orr, 1940:43) and there are 3 to 6 young in a litter.

LEPUS TOWNSENDII CAMPANIUS Hollister.

1837. *Lepus campestris* Bachman, Jour. Acad. Nat. Sci. Philadelphia, 7: 349, not of Meyer, 1790; type locality plains of the Saskatchewan, probably near Carlton House.

1915. *Lepus townsendii campanius* Hollister, Proc. Biol. Soc. Washington, 28:70, March 12.

Marginal records (Nelson, 1909:78, unless otherwise noted).—Saskatchewan: Indian Head (Nelson, 1909:77). Manitoba: Carberry (*ibid.*). Ontario: Rainy River (Anderson, 1947:100). Minnesota (Swanson, Surber and Roberts, 1945:97): Polk County; Otter Tail County; Sherburne County: Washington County. Illinois: Blanding, 6 mi. WNW Hanover (Hoffmeister, 1948:1). Kansas: Red Fork, 60 mi. W Fort Riley; Greensburg (Brown, 1940:387). New Mexico: "near" Taos (V. Bailey, 1932:47); Hopewell. Colorado: Antonito; Fort Garland; Villa Grove; Salida; Como; *Denver;* Mt. Whitely, 25 mi. N Kremmling. Wyoming: Spring Creek; Big Piney; head Glenn Creek, Yellowstone Nat'l Park. Alberta: Great Plains region (Anderson, 1947:99).

LEPUS TOWNSENDII TOWNSENDII Bachman.

1839. *Lepus townsendii* Bachman, Jour. Acad. Nat. Sci. Philadelphia, 8(pt. 1):90, pl. 2, type from Fort Walla Walla, near present town of Wallula, Walla Walla County, Washington.

1904. *Lepus campestris sierrae* Merriam, Proc. Biol. Soc. Washington, 17:132, July 14, type from 7800 ft., Hope Valley, Alpine County, California. Regarded as inseparable from *L. t. townsendii* by Orr, Occas. Papers, California Acad. Sci., 19:42, May 25, 1940.

Marginal records (Nelson, 1909:82, unless otherwise noted).—British Columbia: Fairview, Okanagan Valley. Idaho: Rathdrum Prairie (Rust, 1946:322); Lemhi River; Teton Basin. Wyoming: Hamsfork; Henrys Fork. Colorado: Hot Sulphur Springs; Mt. Baldy; Crested Butte; Mill City. Utah: Kanab. Nevada (Hall, 1946:600): Hamilton; Desatoya Mts.; Santa Rosa Mts. California: Parker Creek, 6300 ft., Warner Mts. Nevada (Hall, 1946:600): 8600 ft., 3 mi. S Mt. Rose; 8900 ft., Lapon Canyon, Mt. Grant; Mt. Magruder. California (Orr, 1940:43): Tuolumne Meadows; Woodfords; Tahoe City; 4700 ft., Steele Meadows. Oregon: Antelope. Washington: Manson (Dalquest, 1948:382).

Lepus californicus

Black-tailed Jack Rabbit

Total length, 465-630; tail, 50-112; hind foot, 112-145; ear from notch (dry), 99-131. Upper parts gray to blackish; tail with black mid-dorsal stripe extending onto back; never all white in winter. On the tableland of Mexico and in the southwestern United States where this species occurs together with the white-sided jack rabbits, *L. californicus* can be recognized by the terminal black patch on the outside of each ear and by the less extensive area of white on the flank. To the eastward, in Tamaulipas, where only the black-tailed jack rabbit occurs, it too, has extensively white flanks and some individuals lack the terminal black patch on the ear.

A certain means for distinguishing the skulls of the black-tailed jack rabbit from those of all of the white-sided jack rabbits has not yet been found. The same is true of the skulls of the white-tailed jack rabbit and the black-tailed jack rabbit in the Great Basin region of Nevada. The skulls, at least of adults, of these two species, in the

region east of the Rocky Mountains can be readily distinguished by the pattern of infolding of the enamel on the front of the first upper incisor teeth; *L. townsendii* has a simple groove on the anterior face of the tooth and *L. californicus,* east of the Rocky Mountains, has a bifurcation, or even trifurcation, of the infold that can readily be seen by examining the occlusal surface of the incisor.

In Arizona, Vorhies and Taylor (1933:478) found the weight of 23 adult males to average 5.1 (4.4-6.1) lbs. In that state, 70 pregnant females averaged 2.24 (1-6) young per litter and the authors (*op. cit.*) thought that a female had three or four litters each year.

Lepus californicus altamirae Nelson.

1904. *Lepus merriami altamirae* Nelson, Proc. Biol. Soc. Washington, 17: 109, May 18, type from Alta Mira, Tamaulipas. Known from type locality only.
1951. *Lepus californicus altamirae,* Hall, Univ. Kansas Publ., Mus. Nat. Hist., 5:45, October 1, 1951.

Lepus californicus asellus Miller.

1899. *Lepus asellus* Miller, Proc. Acad. Nat. Sci., Philadelphia, p. 380, September 29, type from San Luis Potosí, San Luis Potosí.
1909. *Lepus californicus asellus,* Nelson, N. Amer. Fauna, 29:150, August 31.

Marginal records (Nelson, 1909:151).—Coahuila: Jaral. Nuevo Leon: Miquihuana. San Luis Potosí: Río Verde. Aguascalientes: Chicalote. Zacatecas: Valparaiso.

Lepus californicus bennettii Gray.

1844. *Lepus bennettii* Gray, Zoology Voy. *Sulphur,* p. 35, pl. 14, type from San Diego, San Diego County, California.
1909. *Lepus californicus bennetti,* Nelson, N. Amer. Fauna, 29:136, August 31.

Marginal records.—California: Mt. Piños (Orr, 1940:73); Arroyo Seco, Pasadena (Orr, 1940:74); San Felipe Valley (*ibid.*); Jacumba (Nelson, 1909:137). Baja California: San Quintín (Nelson, 1909:137). Northward along coast at least to California: Montalvo (Orr, 1940:73).

Lepus californicus californicus Gray.

1837. *Lepus californica* Gray, Charlesworth's Mag. Nat. Hist., 1:586, type from "St. Antoine," California (probably on coastal slope of mts. near the Mission of San Antonio, Jolon, Monterey County).
1926. *Lepus californicus vigilax* Dice, Occas. Papers Mus. Zool., Univ. Michigan, 166:11, February 11, type from Balls Ferry, Shasta County, California.

Marginal records.—Oregon (Nelson, 1909:132): Drain; Grants Pass. California (Orr, 1940:68-69): Callahan, Scott River; 3300 ft., Lymans, NW of Lyonsville; Dry Creek, Oroville-Chico Road; Snelling; Hernandez; Morro; *Carmel Point; Bolinas Bay; Freestone; Sherwood; Ferndale;* 3 mi. W Arcata. Oregon: Rogue River Valley (Nelson, 1909:132).

LEPUS CALIFORNICUS CURTI Hall.

1951. *Lepus californicus curti* Hall, Univ. Kansas Publ., Mus. Nat. Hist., 5:42, October 1, 1951, type from 88 mi. S and 10 mi. W Matamoros, Tamaulipas. Known from type locality only.

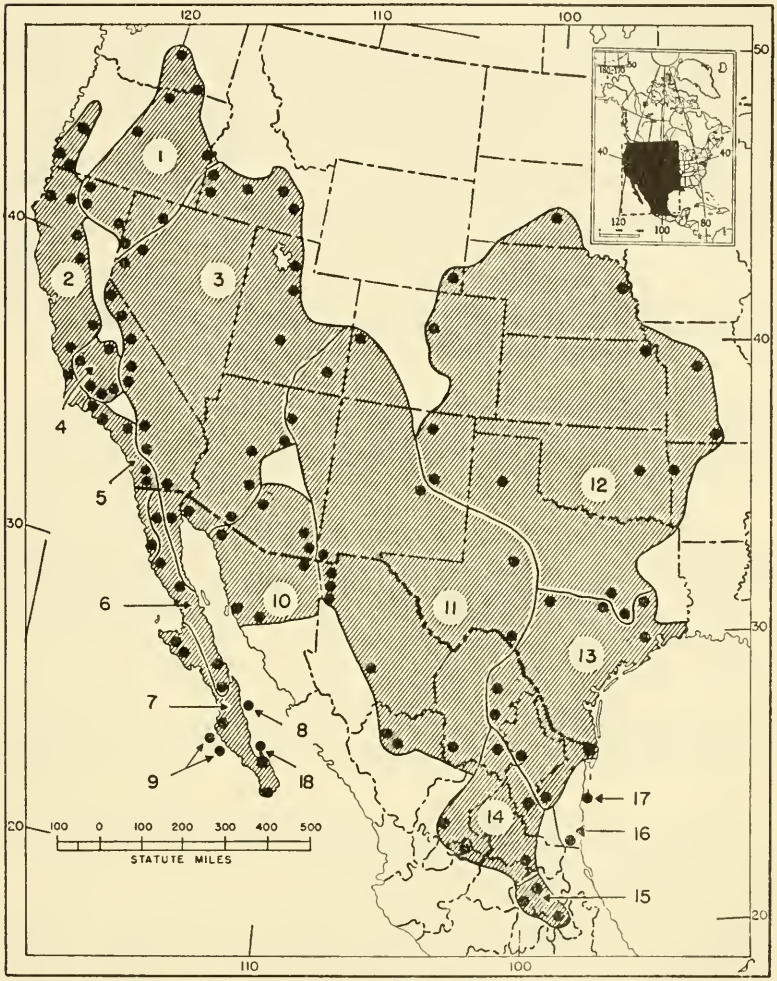


FIG. 47. Distribution of *Lepus californicus* and *Lepus insularis*.

1. *L. c. wallawalla*
2. *L. c. californicus*
3. *L. c. deserticola*
4. *L. c. richardsonii*
5. *L. c. bennettii*
6. *L. c. martirensis*
7. *L. c. xanti*
8. *L. c. sheldoni*
9. *L. c. magdalenae*
10. *L. c. eremicus*
11. *L. c. texianus*
12. *L. c. melanotis*
13. *L. c. merriami*
14. *L. c. asellus*
15. *L. c. festinus*
16. *L. c. altamirae*
17. *L. c. curti*
18. *L. insularis*

Lepus californicus deserticola Mearns.

1896. *Lepus texianus deserticola* Mearns, Proc. U. S. Nat. Mus., 18:564, June 24, type from western edge Colorado Desert, at base of Coast Range Mts., Imperial County, California.
1909. *Lepus californicus deserticola,* Nelson, N. Amer. Fauna, 29:137, August 31.
1932. *Lepus californicus depressus* Hall and Whitlow, Proc. Biol. Soc. Washington, 45:71, April 2, type from ½ mi. S. Pocatello, Bannock County, Idaho. (Regarded as inseparable from *L. c. deserticola* by Davis, The Recent Mammals of Idaho, p. 359, April 5, 1939.)

Marginal records (Nelson, 1909:140, unless otherwise noted).—Idaho (Davis, 1939:360): Boise River; Sawtooth Nat'l Forest; Arco; Blackfoot. Utah: Ogden; Provo; Loa. Arizona: San Francisco Mtn.; Fort Whipple; Phoenix; Rancho Bonito, Abra Valley (Huey, 1942:362). Sonora: El Doctor. Baja California: Calamahue; Esperanza Canyon. California (Orr, 1940-76): Coyote Wells; Kenworthy; Victorville; Farrington Ranch; 5 mi. SW Lone Pine; 10,000 ft., head Silver Canyon; Mono Mills; 5600 ft., near Woodfords. Nevada (Hall, 1946:606): Sutcliffe; ¾ mi. S Sulphur. Idaho: 6 mi. S Murphy (Davis, 1939:360).

Lepus californicus eremicus J. A. Allen.

1894. *Lepus texianus eremicus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:347, December 7, type from Fairbank, Cochise County, Arizona.
1909. *Lepus californicus eremicus,* Nelson, N. Amer. Fauna, 29:140, August 31.

Marginal records (Nelson, 1909:141, unless otherwise noted).—Arizona: Casa Grande; Fort Bowie; 2 mi. E Portal (Cahalane, 1939:435). Chihuahua: San Bernardino Ranch (possibly Nelson should have placed this in Sonora); Colonia Garcia. Sonora: Hermosillo; La Libertad (Burt, 1938:68); Agua Dulce (of Sonora, not of Arizona).

Lepus californicus festinus Nelson.

1904. *Lepus festinus* Nelson, Proc. Biol. Soc. Washington, 17:108, May 18, type from Irolo, Hidalgo.
1909. *Lepus californicus festinus* Nelson, N. Amer. Fauna, 29:151, August 31.

Marginal records (Nelson, 1909:152).—Hidalgo: Zimapan; *Tulancingo;* type locality; Queretaro: Tequisquiapam.

Lepus californicus magdalenae Nelson.

1907. *Lepus californicus magdalenae* Nelson, Proc. Biol. Soc. Washington, 20:81, July 22, type from Magdalena Island, Baja California.

Marginal records.—Baja California (Nelson, 1909:155): type locality; Margarita Island.

Lepus californicus martirensis Stowell.

1895. *Lepus martirensis* Stowell, Proc. California Acad. Sci., 5(ser. 2):51, May 28, type specimen from the San Pedro Mártir Mountains of Baja California.

Marginal records.—Baja California (Nelson, 1909:154): La Huerta; Calamahue; San Bruno; Rancho San José; San Simon.

LEPUS CALIFORNICUS MELANOTIS Mearns.

1890. *Lepus melanotis* Mearns, Bull. Amer. Mus. Nat. Hist., 2:297, February 21, type from Independence, Montgomery County, Kansas.
1909. *Lepus californicus melanotis,* Nelson, N. Amer. Fauna, 29:146, August 31.

Marginal records.—South Dakota: Lyman Co. (Over and Churchill, 1945: 48). Nebraska: Oakland (12399 KU). Kansas: near Doniphan Lake (Linsdale, 1928:146). Missouri: Saline Co. (Enders, 1932:120); 5 mi. E Rockbridge (Leopold and Hall, 1945:145). Arkansas: "about" 2 mi. S Evansville (Dellinger and Black, 1940:190). Oklahoma: 3 mi. E Wainwright (Blair, 1939:128). Texas: Brazos County (Petersen, 1946:166); Golinda (Nelson, 1909:148); Washburn (*ibid.*). New Mexico: Santa Rosa (*ibid.*); vicinity of Cimarron (Hill, 1942:82). Colorado: Semper (Nelson, 1909:148). Wyoming: 3 mi. W Meriden along Horse Cr. (15926 KU).

LEPUS CALIFORNICUS MERRIAMI Mearns.

1896. *Lepus merriami* Mearns, Preliminary diagnoses of new mammals from the Mexican border of the United States, p. 2, March 25, (Reprint: Proc. U. S. Nat. Mus., 18:444, May 23, 1896) type from Fort Clark, Kinney County, Texas.

Marginal records (Nelson, 1909:150, unless otherwise noted).—Texas: Mason; Lott; Antioch; Houston. Tamaulipas: Matamoros; Tamaulipeca, San Carlos Mts. (Dice, 1937:255). Nuevo Leon: Santa Catariña. Coahuila: Monclova; Sabinas.

LEPUS CALIFORNICUS RICHARDSONII Bachman.

1839. *Lepus richardsonii* Bachman, Jour. Acad. Nat. Sci. Philadelphia, 8(pt. 1):88, type from California (exact locality unknown, but probably on interior slope of mts. near Jolon, Monterey County).
1909. *Lepus californicus richardsoni,* Nelson, N. Amer. Fauna, 29:133, August 31.
1904. *Lepus tularensis* Merriam, Proc. Biol. Soc. Washington, 17:136, July 14, type from Alila, Tulare County, California.

Marginal records.—California (Orr, 1940:71): Minkler; Thompson Valley, Walker Basin; Kern Lake Basin; Carrizo Plains, 7 mi. SE Simmler; 2 *mi. E Bryson;* Jolon.

LEPUS CALIFORNICUS SHELDONI Burt.

1933. *Lepus californicus sheldoni* Burt, Proc. Biol. Soc. Washington, 46:37, February 20, type from Carmen Island [(lat. 26° N, long. 111° 12′ W) Gulf of Calif.], Baja California. Known from type locality only.

LEPUS CALIFORNICUS TEXIANUS Waterhouse.

1848. *Lepus texianus* Waterhouse, Nat. Hist. Mamm., 2:136, type locality unknown, but probably in western Texas.
1909. *Lepus californicus texianus,* Nelson, N. Amer. Fauna, 29:142, August 31.
1896. *Lepus texianus griseus* Mearns, Proc. U. S. Nat. Mus., 18:562, June 24, type from Fort Hancock, El Paso County, Texas.
1903. *Lepus (Macrotolagus) texianus micropus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 19:605, November 12, type from Río del Bocas, NW Durango.

Marginal records (Nelson, 1909:146, unless otherwise noted).—Colorado: between Grand Junction and the Utah boundary (Cary, 1911:158). New

Mexico: Roswell (Nelson, 1909:145). Texas (Nelson, 1909:145). Colorado: Comstock. Coahuila: 8 mi. SE San Pedro de los Colonias, 3700 ft (40206 KU). Durango: Río Sestín; Río del Bocas. Chihuahua: Santa Rosalia; Pacheco; San Luis Mts. New Mexico (Nelson, 1909:145): Guadalupe Ranch. Arizona: Painted Desert. Utah: Abajo (Blue Mts.) (Barnes, 1927:149).

Lepus californicus wallawalla Merriam.

1904. *Lepus texianus wallawalla* Merriam, Proc. Biol. Soc. Washington, 17:137, July 14, type from Touchet, Plains of the Columbia, Walla Walla County, Washington.
1909. *Lepus californicus wallawalla,* Nelson, N. Amer. Fauna, 29:132, August 31.

Marginal records.—Washington: Moses Coulee (Dalquest, 1948:386); Touchet (Nelson, 1909:133). Oregon: Ontario (Nelson, 1909:133). Nevada (Hall, 1946:606): 4100 ft., Quinn River Crossing; 4200 ft., 4½ mi. W Flanigan. California (Orr, 1940:79): 5000 ft., 7 mi. E Ravendale; 3600 ft., 1 mi. SE Weed; Hornbrook. Oregon (Nelson, 1909:133): Hay Creek; Willow Junction.

Lepus californicus xanti Thomas.

1898. *Lepus californicus xanti* Thomas, Ann. and Mag. Nat. Hist., 1(ser. 7):45, January, type from Santa Anita, Baja California.

Marginal records.—Baja California (Nelson, 1909:156): Southern part of the Peninsula. Santa Clara Mts., southward around range of *L. c. martirensis* to and down east coast; La Paz; Cape St. Lucas; San Jorgé; 20 mi. W San Ignacio.

Lepus insularis Bryant

Black Jack Rabbit

1891. *Lepus insularis* Bryant, Proc. California Acad. Sci., 3(ser. 2): 92, April 23, type from Espiritu Santo Island, Gulf of California, Baja California. Known from Espiritu Santo Island only.
1895. *Lepus edwardsi* St. Loup, Bull. Mus. Hist. Nat., Paris, 1:5, type from Espiritu Santo Island, Gulf of California, Baja California.

Total length, 574; tail, 96; hind foot, 121; ear from notch (dry), 105. This insular species, clearly a close relative of *Lepus californicus* of the adjacent peninsula of Baja California, is mainly glossy black on the upper parts but grizzled and suffused on sides of back and body, and in some specimens on head, with dark buffy or reddish brown; underparts dark cinnamon buffy or dusky brown; ears and sides of head grayish dusky; jugals heavier than in *Lepus californicus* of the adjacent peninsula of Baja California.

Lepus callotis Wagler

White-sided Jack Rabbit

1830. *Lepus callotis* Wagler, Nat. Syst. der Amphibien, p. 23, type from southern end of Mexican Tableland.
1830. *Lepus mexicanus* Lichtenstein, Abhandl. k. Akad. Wiss., Berlin., p. 101, type from México (southern end of Mexican Tableland).

1833. *Lepus nigracaudatus* Bennett, Proc. Zool. Soc. London, p. 41, type from "that part of California which adjoins to Mexico" (probably southwestern part of Mexican Tableland).

Marginal records (Nelson, 1909:124).—Durango: Durango (city of). San Luis Potosí: Arenal. Hidalgo: Tulancingo. Oaxaca: Oaxaca (city of); Tlapancingo. Jalisco: Atenquiqui; Reyes.

Total length, 560; tail, 71; length of hind foot, 133; ear from notch (dry), 117. Upper parts dark, slightly pinkish, buff heavily washed with black; backs of ears mainly white without terminal patch of black; flanks white; rump iron gray.

FIG. 48. Distribution of the White-sided Jack Rabbits.

Guide to kinds:
1. *Lepus callotis*
2. *Lepus flavigularis*
3. *Lepus gaillardi gaillardi*
4. *Lepus gaillardi battyi*
5. *Lepus alleni alleni*
6. *Lepus alleni palitans*
7. *Lepus alleni tiburonensis*

Lepus flavigularis Wagner

Tehuantepec Jack Rabbit

1844. *Lepus callotis* var γ *flavigularis* Wagner, Schreber's Säugthiere, Suppl., 4:106, type from México (probably near Tehuantepec City, Oaxaca).
1909. *Lepus flavigularis,* Nelson, N. Amer. Fauna, 29:125, August 31.

Marginal records.—Oaxaca (Nelson, 1909:126): Santa Efigenia; San Mateo del Mar; Huilotepec.

Total length, 595; tail, 77; hind foot, 133; ear from notch (dry), 112. Upper parts bright ochraceous buff strongly washed with black; ears entirely buff; nape with black stripe extending back from base of each ear and median stripe of buff; flanks and underparts of body white; rump iron gray; tympanic bullae smaller than in any other *Lepus* of México.

Lepus gaillardi

Gaillard Jack Rabbit

Total length, 450-536; tail, 59-80; hind foot, 124-133; ear from notch (dry), 110-112. Coloration essentially as in *Lepus callotis* except that nape is plain buff, without a trace of black, and upper parts paler, more vinaceous buff.

Lepus gaillardi battyi J. A. Allen.

1903. *Lepus* (*Microtolagus* [*sic*]) *gaillardi battyi* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 19:607, November 12, type from Rancho Santuario, northwestern Durango.

Marginal records.—Durango (Nelson, 1909:122): Río Campo; type locality.

Lepus gaillardi gaillardi Mearns.

1896. *Lepus gaillardi* Mearns, Proc. U. S. Nat. Mus., 18:560, June 24, type from West Fork of Playas Valley, near monument No. 63, Mexican boundary line, Grant County, New Mexico.

Marginal records.—New Mexico: Animas Valley (V. Bailey, 1932:53). Chihuahua (Nelson, 1909:121): Whitewater; Colonia Juarez. New Mexico; type locality.

Lepus alleni

Antelope Jack Rabbit

Total length, 553-670; tail, 48-76; hind foot, 127-150, ear from notch, in flesh, 138-173. Top and sides of head creamy buff, slightly washed on top with black; tail white except for mid-dorsal line of black extending onto rump; sides of shoulders, flanks, sides of abdomen, rump, and outside of hind legs uniform iron gray. The average weight of 61 adult males from Arizona was 8.2 lbs. In that state 124 pregnant females had an average of 1.93 young (1-5) and Vorhies and Taylor (1933:580) thought that a female had three or four litters per year.

LEPUS ALLENI ALLENI Mearns.

1890. *Lepus alleni* Mearns, Bull. Amer. Mus. Nat. Hist., 2:294, February 21, type from Rillito, on the Southern Pacific Railroad, Pima County, Arizona.

Marginal records.—Arizona: Queen Creek (Vorhies and Taylor, 1933:480); Cascabel (*ibid.*); Calabasas (Nelson, 1909:118). Sonora (Burt, 1938): Cerro Blanco (p. 67); Oputo (p. 66); Batamotal (p. 66); La Libertad Ranch (p. 67); Picu Pass (p. 67). Arizona: 2 mi. W Quitovaquita (Huey, 1942:362); Casa Grande (Nelson, 1909:118).

LEPUS ALLENI PALITANS Bangs.

1900. *Lepus* (*Macrotolagus*) *alleni palitans* Bangs, Proc. New England Zool. Club, 1:85, February 23, type from Aguacaliente, about 40 mi. SE Mazatlan, Sinaloa.

Marginal records.—Sonora: near San Bernardo on Río Mayo on Sonora side of Sonora-Chihuahua boundary (Burt and Hooper, 1941:7): *Alamos* (Nelson, 1909:119); Guirocoba (Burt, 1938:68). Nayarit: Acaponeta (Nelson, 1909:119). Sinaloa (Nelson, 1909:119): Esquinapa; *Rosario;* Culiacán. Sonora: "near" Navajoa (Burt, 1938:68).

LEPUS ALLENI TIBURONENSIS Townsend.

1912. *Lepus alleni tiburonensis* Townsend, Bull. Amer. Mus. Nat. Hist., 31:120, June 14, type from Tiburon Island, Gulf of California, Sonora. Known from Tiburon Island only.

Lepus europaeus

European Hare

Total length, 640-700; tail, 70-100; hind foot, 130-150; ear from notch (dry), 79-100; weight, 3000 to 5000 grams. Upper parts tawny, mixed with blackish hairs on back; underparts white including underside of tail; upper side of tail and terminal patch at distal end of outside of ears black; upper side of feet tawny like sides (not white or whitish). This is an introduced species.

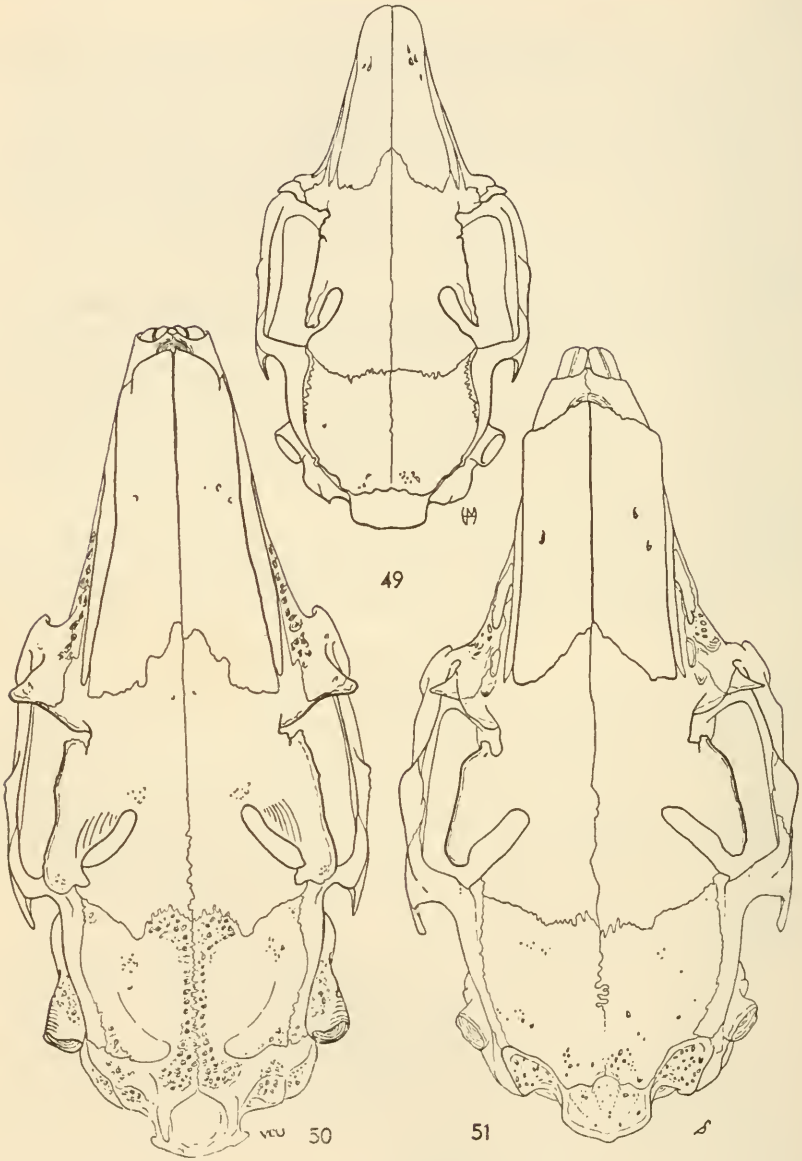
LEPUS EUROPAEUS EUROPAEUS Pallas.

1778. *Lepus europaeus* Pallas, Nov. Spec. Quadr. Glir. Ord., p. 30. Type locality, Burgundy, France. (Introduced and established in Ontario and parts of the northern United States; slowly spreading in southern Ontario north of Lake Erie (St. Thomas and Woodstock), west and north of Lake Ontario (Toronto) to Goodrich on east side of Lake Huron. See Anderson, Canadian Field-Naturalist, 37:75-76, April, 1923; Anderson, Nat. Mus. Canada Bull., 102:100, January 24, 1947; Burt, Mammals of Michigan, p. 247, 1946.)

LEPUS EUROPAEUS HYBRIDUS Desmarest.

1822. *Lepus hybridus* Desmarest, Encyclopedie methodique (Zoologie) Mammalogie, pt. 1, p. 349 (Name based on "Russac" of Pallas, Nov. Spec. Quadr. Glir. Ord., p. 5, 1778), type locality central Russia.
1912. *Lepus europaeus hybridus*, Miller, Cat. Mamm., western Europe, Publ., British Mus. (Nat. Hist.), p. 508, November 23, 1912.

Range.—Introduced and established in New York and Connecticut (see Goodwin, Connecticut Geol. and Nat. Hist. Survey, Bull. 53:159-162, 1935).

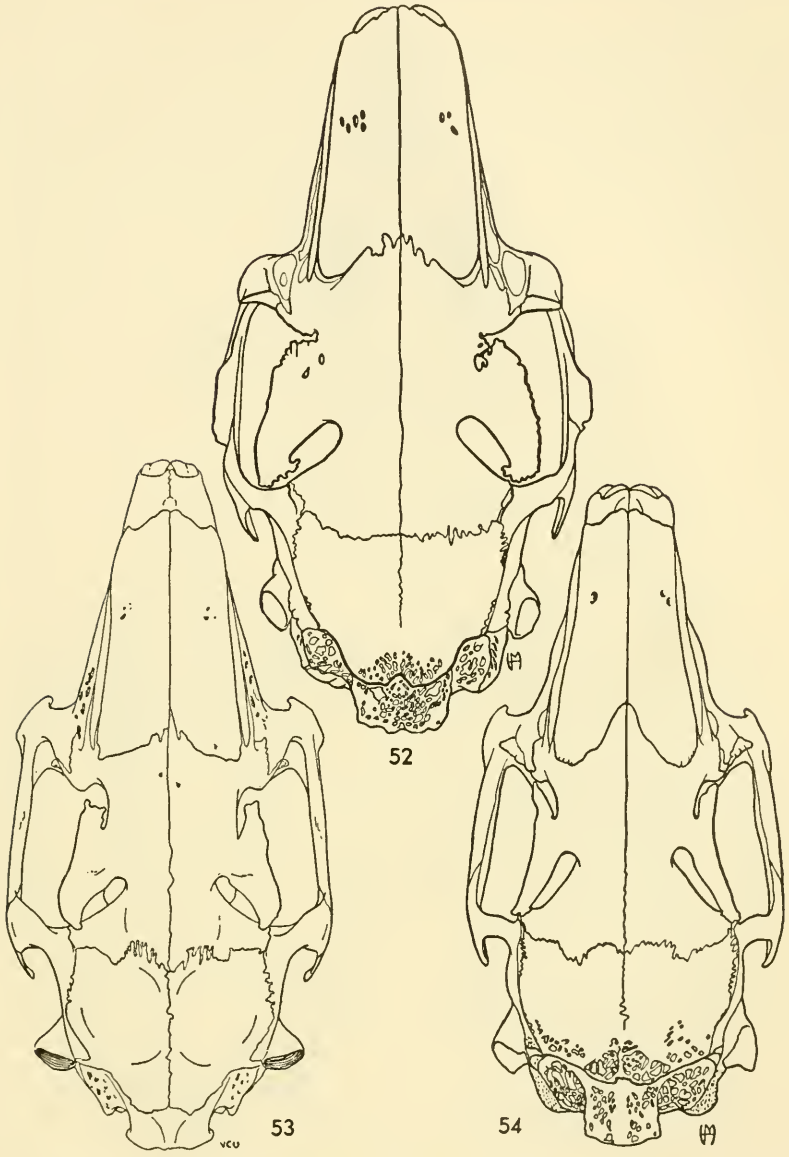


FIGS. 49-51. Dorsal views of skulls of hares. All × 1.

FIG. 49. *Lepus americanus tahoensis*, ½ mi. S Tahoe Tavern, Lake Tahoe, Placer County, California. No. 37522 MVZ, ♂.

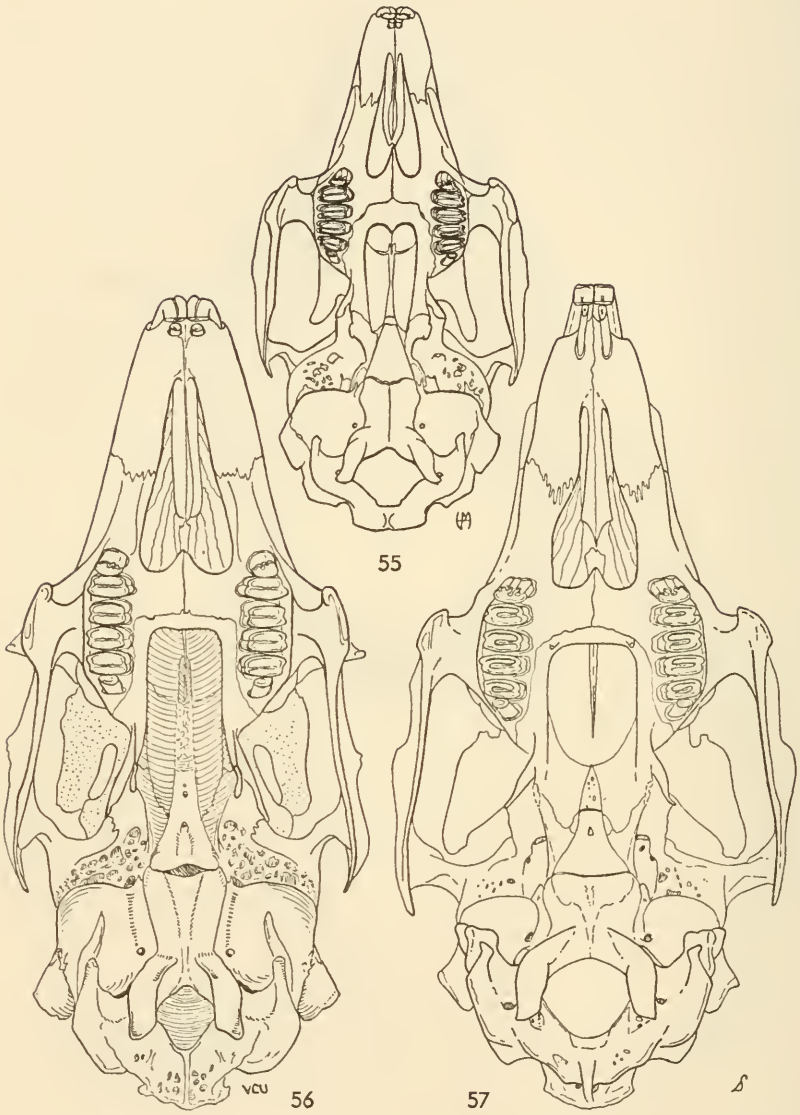
FIG. 50. *Lepus alleni alleni*, Santa Rita Mountains, 30 mi. S Tucson, Pima County, Arizona. No. 8621 KU, ♂.

FIG. 51. *Lepus arcticus groenlandicus*, Cape Alexander, Greenland. No. 114850 USNM, ♂.



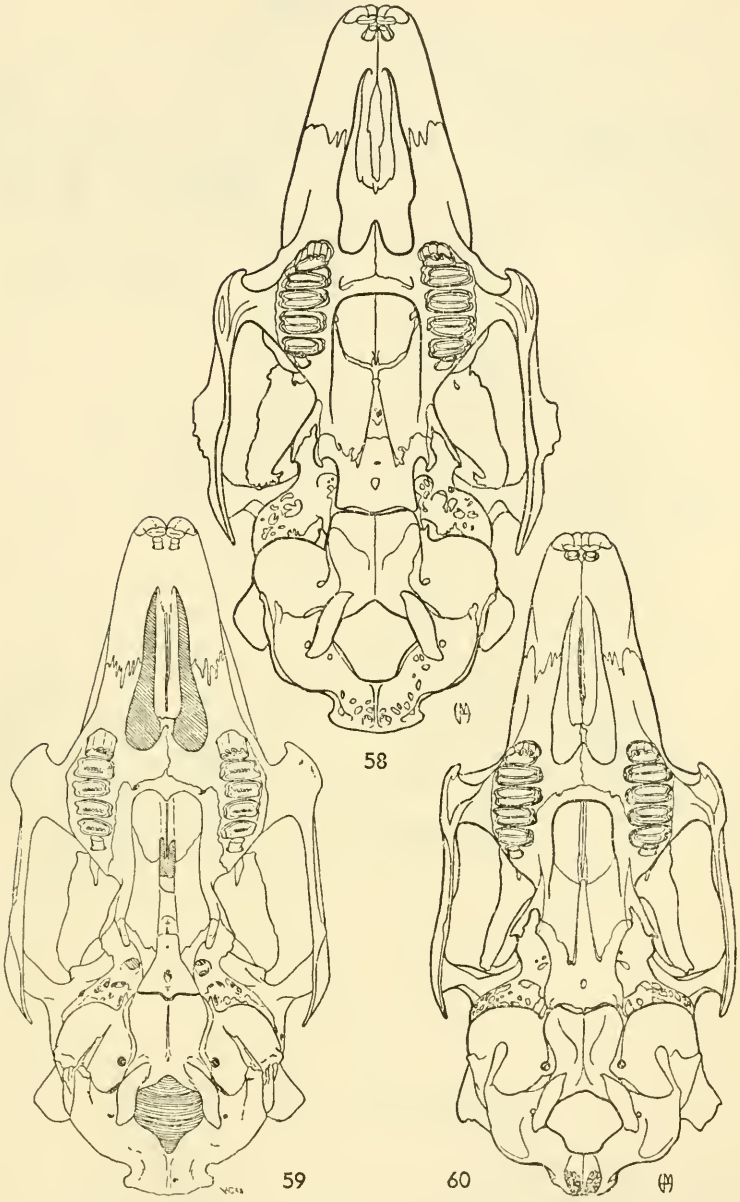
FIGS. 52-54. Dorsal views of skulls of hares. All × 1.

FIG. 52. *Lepus townsendii townsendii*, north end Ruby Valley, east base Ruby Mountains, Elko County, Nevada. No. 4686, coll. of Ralph Ellis, ♀.
FIG. 53. *Lepus callotis*, 3½ mi. S Tecolotlán, Jalisco. No. 31842 KU, ♀.
FIG. 54. *Lepus californicus deserticola*, 4 mi. W Fallon, Churchill County, Nevada. No. 900061 MVZ, ♂.



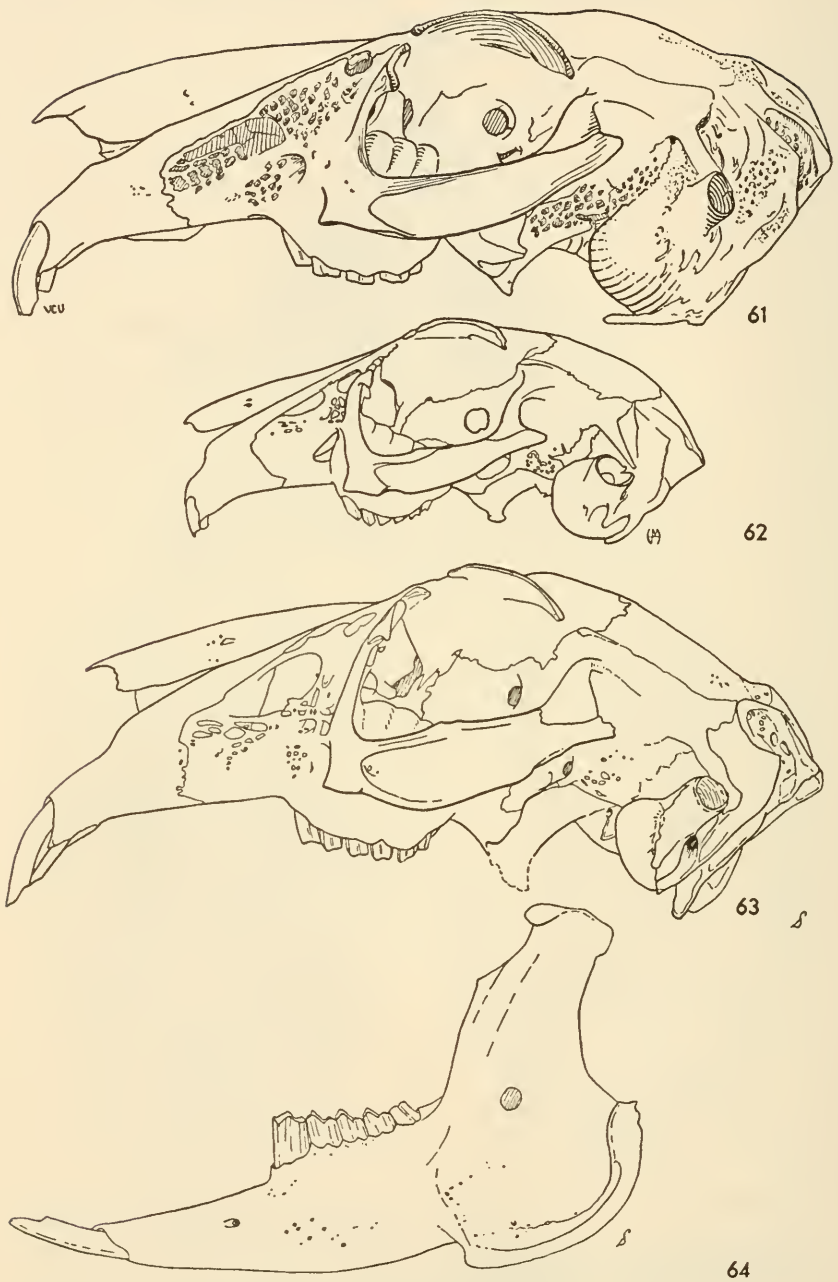
FIGS. 55-57. Ventral views of skulls of hares. All × 1. Different views of these skulls are shown in figs. 49-51.

FIG. 55. *Lepus americanus tahoensis.* FIG. 56. *Lepus alleni alleni.*
FIG. 57. *Lepus arcticus groenlandicus.*



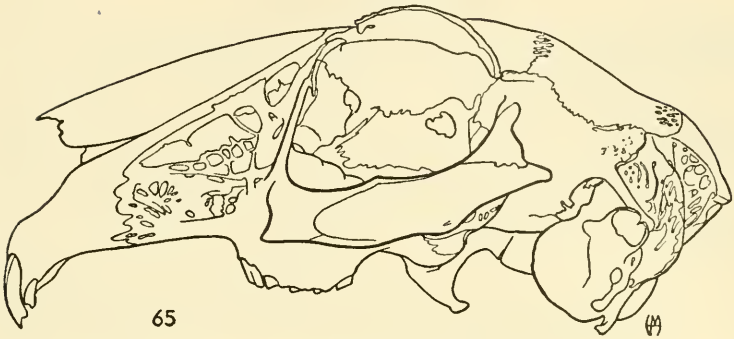
FIGS. 58-60. Ventral views of skulls of hares. All × 1. Different views of these skulls are shown in figs. 49-51.

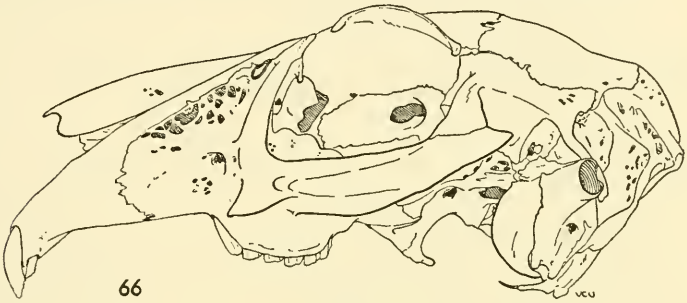
FIG. 58. *Lepus townsendii townsendii.* FIG. 59. *Lepus callotis.*
FIG. 60. *Lepus californicus deserticola.*

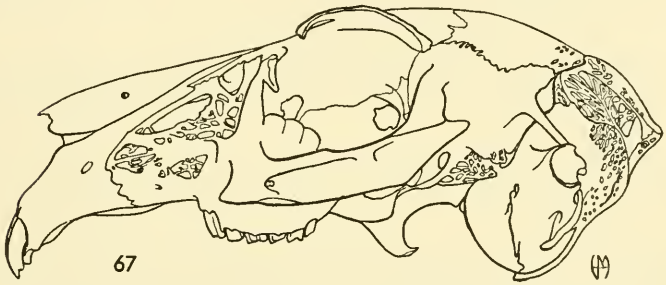


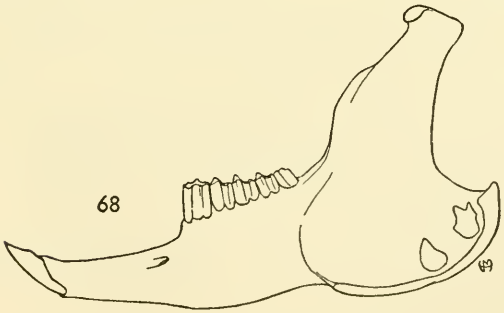
FIGS. 61-64. Lateral views of skulls (one lower jaw) of hares. All × 1. Different views of these skulls are shown in figs. 49-51.

FIG. 61. *Lepus alleni alleni.* FIG. 62. *Lepus americanus tahoensis.*
FIGS. 63-64. *Lepus arcticus groenlandicus.*









FIGS. 65-68. Lateral views of skulls (one lower jaw) of hares. All × 1. Different views of these skulls are shown in figs. 52-54.

FIG. 65. *Lepus townsendii townsendii.* FIG. 66. *Lepus callotis.*
FIGS. 67-68. *Lepus californicus deserticola.*

LITERATURE CITED

Allen, J. A.

1910. Additional mammals from Nicaragua. Bull. Amer. Mus. Nat. Hist., 28:87-115, April 30.

Anderson, R. M.

1947. Catalogue of Canadian Recent mammals. Bull. Nat. Mus. Canada, 102:v + 238, January 24.

Anderson, R. M., and Rand, A. L.

1943. A synopsis of the rodents of the southern parts of the Prairie Provinces of Canada. Special contribution-43-1, Canada, Dept. Mines and Resources, Mines and Geol. Branch, pp. 1-25, 13 illustrations (mimeographed MS). On the front of the self cover below the date 1943 there is stamped "April 27, 1939".

Bailey, A. M., and Hendee, R. W.

1926. Notes on the mammals of northwestern Alaska. Jour. Mamm., 7:9-28, 3 pls., February 15.

Bailey, V.

1927. A biological survey of North Dakota. N. Amer. Fauna, 49:vi + 226, 21 pls., 8 figs. in text, January 8.

1932. Mammals of New Mexico. N. Amer. Fauna, 53:1-412, 22 pls., 56 figs. in text, March 1.

1936. The mammals and life zones of Oregon. N. Amer. Fauna, 55:1-416, 51 pls. (nos. 2-52), 102 figs. in text, 1 map, August 29.

Barnes, C. T.

1927. Utah mammals. Bull. Univ. of Utah, 17(12):1-183, Frontispiece, 31 maps, June.

Black, J. D.

1936. Mammals of northwestern Arkansas. Jour. Mamm., 17:29-35, February 17.

Blair, W. F.

1936. The Florida Marsh rabbit. Jour. Mamm., 17:197-207, August 17.

1938. A new race of the eastern cottontail from the Texas Panhandle. Occas. Papers, Mus. Zool., Univ. Michigan, no. 380:1-3, June 21.

1939. Faunal relationships and geographic distribution of mammals in Oklahoma. Amer. Midl. Natur., 22:85-133, 1 fig., July.

1940. A contribution to the ecology and faunal relationships of the mammals of the Davis Mountain Region, Southwestern Texas. Misc. Publ., Mus. Zool., Univ. Michigan, 46:1-39, 3 pls., June 28.

Bole, B. P., Jr., and Moulthrop, P. N.

1942. The Ohio Recent mammal collection in the Cleveland Museum of Natural History. Scientific Publs., Cleveland Mus. Nat. Hist., 5: 83-181, September 11.

Borell, A. E., and Bryant, M. D.

1942. Mammals of the Big Bend area of Texas. Univ. California Publ. Zool., 48:1-62, 5 pls., 1 fig. in text, August 7.

BROWN, L.
1940. The distribution of the white-tailed jack rabbit (*Lepus townsendii campanius* Hollister) in Kansas. Trans. Kansas Acad. Sci., 43:385-389.

BURT, W. H.
1938. Faunal relationships and geographic distribution of mammals in Sonora, Mexico. Misc. Publ., Mus. Zool., Univ. Michigan, 39:1-77, 3 tables, 26 maps, February 15.
1946. The mammals of Michigan. Univ. Michigan Press, Ann Arbor, xv + 1-288 pp., illustrated.

BURT, W. H., and HOOPER, E. T.
1941. Notes on mammals from Sonora and Chihuahua, Mexico. Occas. Papers, Mus. Zool., Univ. Michigan, 430:1-7, May 27.

CAHALANE, V. H.
1939. Mammals of the Chiricahua Mountains, Cochise County, Arizona. Jour. Mamm., 20:418-440, 3 figs. in text, November 14.

CARY, M.
1911. A Biological survey of Colorado. N. Amer. Fauna, 33:1-256, 12 pls., 39 figs. in text, August 17.

COCKRUM, E. L.
1949. Range-extension of the swamp rabbit in Illinois. Jour. Mamm., 30:427-429, 1 fig. in text, November 17.

COWAN, I. McT.
1938. Notes on the hares of British Columbia with the description of a new race. Jour. Mamm., 19:240-243, May 12.
1940. Two mammals new to the known fauna of British Columbia. The Murrelet, 21:9, April 30.

DALQUEST, W. W.
1941. Distribution of cottontail rabbits in Washington. Jour. Wildlife Manag., 5:408-411, October.
1942. Geographic variation in northwestern snowshoe hares. Jour. Mamm., 23:166-183, 2 figs. in text, June 3.
1948. Mammals of Washington. Univ. Kansas Publ., Mus. Nat. Hist., 2:1-444, 140 figs. in text, April 9.
1950. Records of mammals from the Mexican state of San Luis Potosí. Occas. Papers Mus. Zool., Louisiana State Univ., 23:1-15, July 10.

DAVIS, W. B.
1937. Some mammals from western Montana and eastern Idaho. Murrelet 18:22-27, September 4.
1939. The Recent mammals of Idaho. The Caxton Printers, Caldwell, Idaho, 400 pp., 2 full pages half tones, 33 figs. in text, April 5.
1944. Notes on Mexican mammals. Jour. Mamm., 25:370-403, 1 fig. in text, December 12.

DAVIS, W. B., and ROBERTSON, J. L., Jr.
1944. The mammals of Culberson County, Texas. Jour. Mamm., 25:254-273, 1 pl., 2 figs. in text, September 8.

DELLINGER, S. C., and BLACK, J. D.
1940. Notes on Arkansas mammals. Jour. Mamm., 21:187-191, May 16.

Dice, L. R.
1921. Notes on the mammals of interior Alaska. Jour. Mamm., 2:20-28, February 10.
1926. Notes on Pacific Coast rabbits and pikas. Occas. Papers, Mus. Zool., Univ. Michigan, 166:1-28, February 11.
1937. Mammals of the San Carlos Mountains and vicinity. Michigan studies, Sci. Ser., 12:245-268, 3 pls.

Durrant, S. D.
MS. The mammals of Utah. 826 pp., illustrated—on file Mus. Nat. Hist., Univ. Kansas, Lawrence, Kansas, as of May, 1950.

Enders, R. K.
1932. Mammal distribution in Saline and Camden counties, Missouri. Amer. Midland Nat., 13:114-123, May.

Goldman, E. A.
1920. Mammals of Panama. Smithsonian Misc. Coll., 69(5):1-309, 39 pls., 24 figs. in text, April 24.

Goodwin, G. G.
1934. Mammals collected by A. W. Anthony in Guatemala 1924-1928. Bull. Amer. Mus. Nat. Hist., 68:1-60, 5 pls., December 12.
1935. The mammals of Connecticut. Bull. Connecticut State Geol. and Nat. Hist. Surv., 53:1-221, 33 pls., 19 figs. in text.
1942. Mammals of Honduras. Bull. Amer. Mus. Nat. Hist., 79:107-195, May 29.
1946. Mammals of Costa Rica. Bull. Amer. Mus. Nat. Hist., 87:271-473, 1 pl., 50 figs. in text, 1 map, December 31.

Hall, E. R.
1946. Mammals of Nevada. Univ. California Press, Berkeley, xi + 710, colored frontispiece, 11 pls., 485 figs. in text, plus 54 silhouettes, July 1.

Hall, E. R., and Bowlus, H. L.
1938. A new pika (mammalian genus Ochotona) from southeastern Idaho with notes on near-by subspecies. Univ. California Publ. Zool., 42: 335-339, 1 fig. in text, July 7.

Hall, E. R., and Kelson, K. R.
1951. Comments on the taxonomy and geographic distribution of some North American rabbits. Univ. Kansas Publ., Mus. Nat. Hist., 5:49-58, October 1, 1951.

Hall, E. R., and Villa R., B.
1949. An annotated check list of the mammals of Michoacán, México. Univ. Kansas Publ., Mus. Nat. Hist., 1:433-472, 2 pls., 1 fig. in text, December 27.

Hamilton, W. J., Jr.
1943. The mammals of eastern United States. Comstock Publishing Co., Inc., Ithaca, pp. 1-432, illustrated.

Handley, C. O., Jr., and Patton, C. P.
1947. Wild mammals of Virginia. Commonwealth of Virginia Comm. Game and Inland Fisheries, Richmond. vi+220 pp. Frontispiece + 103 figs. in text.

HARRISON, T., and NICKIE, P. F.
1931. Indiana's swamp rabbit. Jour. Mamm., 12:319-320, August 24.

HILL, J. E.
1942. Notes on mammals of northeastern New Mexico. Jour. Mamm., 23:75-82, 1 fig. in text, February 16.

HOFFMEISTER, D. F.
1948. A specimen of the white-tailed jack rabbit, *Lepus townsendii*, from Illinois. Chicago Acad. Sci., Nat. Hist. Miscellanea, 29:1-2, October 15.

HOOPER, E. T.
1947. Notes on Mexican mammals. Jour. Mamm., 28:40-57, February 17.

HOWELL, A. H.
1909. Notes on the distribution of certain mammals in the southeastern United States. Proc. Biol. Soc. Washington, 22:55-68, April 17.
1921. A biological survey of Alabama. N. Amer. Fauna, 45:1-88, 10 figs. in text, October 28.
1924. Revision of the American pikas. N. Amer. Fauna, 47:iv + 57, 6 pls., 4 figs., September 23.
1936. A revision of the American Arctic hares. Jour. Mamm., 17:315:337, 4 figs. in text, November 16.

HUEY, L. M.
1927. A new kangaroo rat and a new brush rabbit from Lower California, Mexico. Trans. San Diego Soc. Nat. Hist., 5:65-68, July 6.
1940. A new coastal form of brush rabbit from the vicinity of San Quintín, Lower California, Mexico. Trans. San Diego Soc. Nat. Hist., 9:221-224, July 31.
1942. A vertebrate faunal survey of the Organ Pipe Cactus National Monument, Arizona. Trans. San Diego Soc. Nat. Hist., 9:353-375, 1 map, February 17.

KELLOGG, R.
1937. Annotated list of West Virginia mammals. Proc. U. S. Nat. Mus., 84:443-479, prior to November 17.
1939. Annotated list of Tennessee mammals. Proc. U. S. Nat. Mus., 86: 245-303, prior to March 27.

LANGENBACH, J. R., and BEULE, J. D.
1942. A progress report on cottontail rabbits in Pennsylvania. Pennsylvania Game News, 13(8):14, 15, and 30, 3 photos., 2 tables. Only the reprint (lacking photos.) seen.

LEOPOLD, A. S., and HALL, E. R.
1945. Some mammals of Ozark County, Missouri. Jour. Mamm., 26:142-145, July 19.

LINSDALE, J.
1928. Mammals of a small area along the Missouri River. Jour. Mamm., 9:140-146, May 9.

LLEWELLYN, L. M., and HANDLEY, C. O.
1946. The cottontail rabbits of Virginia. Jour. Mamm., 26:379-390, February 12.

Lowery, G. H., Jr.
1936. A preliminary report on the distribution of the mammals of Louisiana. Proc. Louisiana Acad. Sci., 3:11-39, 4 pls., 2 figs. in text, March.

Lyman, C. P.
1943. Control of coat color in the varying hare, *Lepus americanus* Erxleben. Bull. Mus. Comp. Zool., 93:393-461, illustrated.

Lyon, M. W., Jr.
1904. Classification of the hares and their allies. Smithsonian Misc. Coll., 45:321-447, pls. 74-100, figs. 44-45, June 15.

Manville, R. H.
1942. Notes on the mammals of Mount Desert Island, Maine. Jour. Mamm., 23:391-398, December 30.

Martin, K.
1943. The Colorado pika. Jour. Mamm., 24:394-396, August 18.

Miller, G. S., Jr.
1924. List of North American Recent mammals. Bull. U. S. Nat. Mus., 128:xvi + 673, April 29.

Necker, W. L., and Hatfield, D. M.
1941. Mammals of Illinois. Bull. Chicago Acad. Sci., 6:17-60, 15 figs. in text, May 15.

Nelson, E. W.
1909. The rabbits of North America. N. Amer. Fauna, 29:1-314, 13 pls., 19 figs. in text, August 31.

Orr, R. T.
1935. Descriptions of three new races of brush rabbit from California. Proc. Biol. Soc. Washington, 48:27-30, February 6.
1940. The rabbits of California. Occas. Papers, California Acad. Sci., 19:1-227, 10 pls., 30 figs. in text, May 25.

Osgood, F. L., Jr.
1938. The mammals of Vermont. Jour. Mamm., 19:435-441, November 14.

Over, W. H., and Churchill, F. P.
1945. Mammals of South Dakota. Museum, Univ. S. Dakota, pp. 3 + 56 + 3 (MS, mimeographed, including one map).

Palmer, R. S.
1944. New England Cottontail in Maine. Jour. Mamm., 25:193-195, May 26.

Peterson, R. L.
1946. Recent and Pleistocene mammalian fauna of Brazos County, Texas. Jour. Mamm., 27:162-169, 5 figs. in text, May 14.

Philip, C. B.
1939. A parasitological reconnaissance in Alaska with particular reference to varying hares. Jour. Mamm., 20:82-86, February 15.

Rausch, R.
1950. Notes on the distribution of some Arctic mammals. Jour. Mamm., 31:464-466, November 21.

Rust, H. J.
1946. Mammals of Northern Idaho. Jour. Mamm., 27:308-327, 1 fig., 1 tab., November 25.

SCHANTZ, V. S.
1947. Extension of the range of Brachylagus idahoensis. Jour. Mamm., 28:187-188, 1 fig. in text, June 1.

SEVERAID, J. H.
1945. Pelage changes in the snowshoe hare. . . . Jour. Mamm., 26: 41-63, 15 figs. in text, February 27.
1950. The pigmy rabbit (*Sylvilagus idahoensis*) in Mono County, California. Jour. Mamm., 31:1-4, February 21.
1950. The gestation period of the pika (*Ochotona princeps*). Jour. Mamm., 31:356-357, August 21.

SHERMAN, H. B.
1936. A list of the Recent land mammals of Florida. Proc. Florida Acad. Sci., 1:102-128.

SHERMAN, F.
1939. The swamp rabbit (Sylvilagus aquaticus aquaticus) in South Carolina. Jour. Mamm., 20:259, May 15.

SILVER, J.
1924. The European hare (Lepus europaeus Pallas) in North America. Jour. Agric. Research, 28:1133-1137, 1 fig. in text, June 14.

SNYDER, L. L., and LOGIER, E. B. S.
1930. A faunal investigation of King Township, York County, Ontario. Trans. Royal Canadian Inst., 17(pt. 2):167-208, 3 pls.

SOPER, J. D.
1942. Mammals of Wood Buffalo Park, northern Alberta and District of Mackenzie. Jour. Mamm., 23:119-145, 2 pls. 1 fig. in text, June 3.
1946. Mammals of the northern Great Plains along the international boundary in Canada. Jour. Mamm., 27:127-153, 1 fig. in text, May 14.

SOUTHERN, H. N.
1942. Periodicity of refection in the wild rabbit. Nature, 149:553, May 16.

STEAD, D. G.
1925. Australian Encyclopedia, vol. 2, pp. 355-358—article on rabbit.

SURBER, T.
1932. The mammals of Minnesota. Minnesota Dept. Conservation, 8 vo., pp. 1-84, illustrated.

SWANSON, G., SURBER, T., and ROBERTS, T. S.
1945. The mammals of Minnesota. Minnesota Dept. Conservation, Tech. Publ., 2:1-108, numerous unnumbered pls. and figs.

TAYLOR, W. P., and SHAW, W. T.
1929. Provisional list of land mammals of the State of Washington. Occas. Pap. Chas. R. Conner Mus., No. 2, pp. 1-32, December.

VORHIES, C. T., and TAYLOR, W. P.
1933. The life-histories and ecology of jack rabbits, *Lepus alleni* and *Lepus californicus* ssp., in relation to grazing in Arizona. Tech. Bull., Univ. Arizona, College Agric., Agric. Exp. Station, 49:468-587, 12 pls., 5 figs. in text, 17 tables, May 31.

WARREN, E. R.
1942. The mammals of Colorado. Univ. of Oklahoma Press. xviii + 330 pp., 50 pls.

Wodzicki, K. A.
1950. Introduced mammals of New Zealand. . . . x + 255 pp., illustrated. Published by Dept. Sci. and Industrial Res., Wellington, New Zealand.

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23-7988

A New Pocket Mouse (Genus Perognathus) from Kansas

BY

E. LENDELL COCKRUM

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23-8186

A New Pocket Mouse (Genus Perognathus) from Kansas

BY

E. LENDELL COCKRUM

In studying the kinds of mammals known from Kansas, I had occasion to examine a series of *Perognathus flavus* from the western part of the state. Comparisons of these specimens with topotypes of named subspecies revealed that the specimens from Kansas belong to a heretofore underscribed subspecies which ranges through western Nebraska, eastern Colorado, western Kansas, and western Oklahoma. This subspecies is named and described as follows.

Perognathus flavus bunkeri, new subspecies

Type.—Female, adult, skin and skull; No. 11716, Univ. Kansas Mus. Nat. Hist.; Conard Farm, 1 mi. E Coolidge, Hamilton County, Kansas; 1 July 1936; obtained by F. Parks and C. W. Hibbard, original No. 894 of Hibbard.

Diagnosis.—Size large (see measurements). Color light, upper parts between Pinkish Buff and Cinnamon-Buff (capitalized color terms after Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912), sparsely mixed with black hairs; the effect at a distance of eight feet, is between Clay Color and Tawny-Olive; lateral line between Pinkish Buff and Cinnamon-Buff; postauricular spots near Pinkish Buff; small subauricular spots white; underparts white. Skull of medium size (see measurements); frontonasal and mastoidal regions much enlarged; interparietal transversely narrow.

Comparisons.—From topotypes of *P. f. flavus* from El Paso, El Paso County, Texas, *P. f. bunkeri* differs as follows: Averaging larger in all cranial measurements taken except in occipitonasal length, which is approximately the same, and in interparietal width, which is less; color more buffy, with fewer black hairs dorsally. From topotypes of *P. f. piperi* from 23 miles southwest of Newcastle, Weston County, Wyoming, *P. f. bunkeri* differs as follows: Smaller in frontonasal length, mastoidal breadth, and length of auditory bulla; color more buffy, with fewer black hairs dorsally. From topotypes of *P. f. sanluisi* from nine miles east of Center, Alamosa County, Colorado, *P. f. bunkeri* differs as follows: Averaging larger in all cranial measurements taken except interparietal width, which is smaller; color lighter and more buffy.

Remarks.—This is a brightly colored subspecies of *Perognathus flavus,* with less black dorsally than any adjacent one. The lateral line is well marked. Three young adult specimens taken from Wakeeney, Trego County, Kansas, are much brighter than other specimens from Kansas. The five specimens from Greeley, Weld County, Colorado, are much darker dorsally, like *P. f. piperi,* but are referable to *P. f. bunkeri* on the basis of cranial characters.

The name *P. f. bunkeri* is proposed in recognization of the continued attention which the late Charles Dean Bunker, Curator of Birds and Mammals of the University of Kansas Museum of Natural History, gave to building up the collection of mammals from Kansas. Acknowledgment is made of the assistance afforded me by a Research Assistantship with the Kansas Biological Survey.

Measurements.—Measurements of holotype and average of four adults (two males and two females) from the type locality are as follows: total length, 104, 105.2; length of tail, 44, 47.5; length of hind foot, 16, 16.7; length of ear, 7, 7.2; occipitonasal length, 20.6, 20.9; frontonasal length, 14.0, 13.9; mastoidal breadth, 12.1, 12.0; length of bulla, 8.0, 7.8; interorbital breadth, 4.5, 4.6; alveolar length of upper molariform tooth-row, 3.3, 3.1; interparietal width, 3.2, 3.2. All of the measurements listed above are available for each of the five specimens except that the occipitonasal length and frontonasal length are not available for the two males.

Specimens examined.—Total, 54, distributed by localities of capture as shown below. Those from Nebraska and Colorado are in the US Nat'l Mus., Biol. Surv. Coll., and those from Kansas are in the Univ. Kansas Mus. Nat. Hist.

Nebraska:—*Box Butte Co.:* Alliance, 1.

Colorado:—*Weld Co.:* Greeley, 5. *Kit Carson Co.:* Burlington, 1. *Fremont Co.:* Canon City, 1.

Kansas:—*Cheyenne County:* 23 mi. [by road] NW St. Francis, 1. *Rawlins County:* 12 mi. NE McDonald, 1; 2 mi. NE Ludell, 1. *Decatur County:* 2 mi. S, 6 mi. W Oberlin, 1. *Logan County:* Vincent Ranch, N. Fork Smoky R., [= 4 mi. W and 8 mi. N McAllaster], 2; unspecified, 1. *Gove County:* Castle Rock, 1. *Trego County:* Wakeeney, 3. *Hamilton County:* 1 mi. E Coolidge, 8. *Stanton County:* 6 mi. W, 1½ mi. S Manter, 1; 8½ mi. W, 2½ mi. S Manter, 1. *Kiowa County:* Rezeau Ranch, 5 mi. N Belvidere, 1. *Morton County:* 9 mi. N, 3 mi. E Elkhart, 18. *Meade County:* 9 mi. SW Meade, 1; 17 mi. SW Meade, 2. *Clark County:* Stephenson Ranch, 7 mi. S Kingsdown, 1.

Oklahoma:—*Texas County:* 2 mi. E Eva, 1.

University of Kansas, Museum of Natural History, Lawrence, Kansas.

Transmitted May 14, 1951.

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Mammals from Tamaulipas, Mexico

BY

ROLLIN H. BAKER

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Mammals from Tamaulipas, Mexico

By

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Forming the northeastern border of Mexico, Tamaulipas extends in an elongated, north-south direction from the Temperate into the Torrid Zone and contains faunal elements from both the Nearctic and Neotropical regions. The mammals are less known than those from some of the bordering states; for the most part collecting has been limited to a few localities, chiefly along the Pan-American Highway. Accordingly, as a step towards a long-range study of the mammals of Tamaulipas, the Museum of Natural History of the University of Kansas acquired from William J. Schaldach, Jr., a small, but significant, collection of mammals taken in the last month of 1949 and the first four months of 1950.

Collections were made at several places in the vicinity of Ciudad Victoria, including localities along the humid, eastern face of the Sierra Madre Oriental. Many of these specimens were obtained near camps made west of the village of El Carrizo. This small community is on the Pan-American highway, 70 kilometers (by highway) south of Ciudad Victoria. The resulting collections, which are reported upon here, disclose that several tropical mammals range farther northward than previously reported. Funds for financing the field work were made available by a grant from the Kansas University Endowment Association.

ACCOUNTS OF SPECIES

Didelphis mesamericana mesamericana Oken

Central American Opossum

Did[elphys] mes-americana Oken, Lehrbuch d. Naturgesch., pt. 3, vol. 2: 1152, 1816. (Type from Northern Mexico.)
Didelphis mes-americana Allen, Bull. Amer. Mus. Nat. Hist., 16:256, August 18, 1902.

Specimens examined, 2 as follows: 36 km. N and 10 km. W Ciudad Victoria, 1 km. E El Barretal, on Río Purificacíon, 1; 12 km. N and 4 km. W Ciudad Victoria, 1.

Philander opossum pallidus (Allen)

Four-eyed Opossum

Metachirus fuscogriseus pallidus Allen, Bull. Amer. Mus. Nat. Hist., 14:215, July 3, 1901. (Type from Orizaba, Veracruz, Mexico.)
Philander opossum pallidus Dalquest, Occ. Papers Mus. Zool., Louisiana State Univ., No. 23:2, July 10, 1950.

Specimens examined, 3 from 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo.

Remarks.—These three specimens have proportionately longer tails than typical *P. o. pallidus* from central Veracruz; total length and length of tail of two adult males are 575, 295, and 568, 290 respectively.

This marsupial has been previously unrecorded from Tamaulipas or from so northward a locality. The four-eyed opossum evidently ranges northward along the east face of the Sierra Madre Oriental within the humid division of the Upper Tropical Life-zone. These animals, all males, were taken in steel traps baited with the bodies of skinned mice or birds. Sets were made along well-used trails leading from a densely vegetated arroyo into a corn field through openings in a fence of roughly piled logs. The elevation of this locality is approximately 2500 feet.

Desmodus rotundus murinus Wagner

Vampire Bat

D[esmodus] murinus Wagner, Schreber's Säugthiere, Suppl., 1:377, 1840. (Type from Mexico.)
Desmodus rotundus murinus Osgood, Field Mus. Nat. Hist., publ. 155, zool. ser., 10:63, January 10, 1912.

Specimens examined, 9 as follows: 12 km. W and 8 km. N Ciudad Victoria, 2500 ft., 3; 70 km. [by highway] S Ciudad Victoria and 6 km. W of the [Pan-American] highway [at El Carrizo], 6.

Remarks.—Vampire bats were taken at two caves. At the cave called "Los Troncones", 12 kilometers west and 8 kilometers north of Ciudad Victoria, seven bats were shot down; three were saved. The second cave, south of Ciudad Victoria, was considerably damper than the first. Vampires were found in a small side chamber; nine bats were knocked down. No other kinds of bats were present in either cave.

Sylvilagus floridanus connectens (Nelson)

Florida Cottontail

Lepus floridanus connectens Nelson, Proc. Biol. Soc. Washington, 17:105, May 18, 1904. (Type from Chichicaxtle, Veracruz, Mexico.)
Sylvilagus floridanus connectens Lyon and Osgood, Catal. Type spec. Mamm. U. S. Nat. Mus., Bull. 62:32, January 28, 1909.

Specimens examined, 2 from 70 km. [by highway] S. Ciudad Victoria and 2 km. W El Carrizo.

Sciurus aureogaster aureogaster F. Cuvier

Red-bellied Squirrel

[*Sciurus,* by implication] *aureogaster* F. Cuvier, Hist. nat. mammifères, vol. 6, livr. 59, pl. with text, September, 1829. Binomial published at end of work only, vol. 7, tabl. generale et méthodique, p. 4, 1842. (Type from "California" = eastern Mexico.)

Specimens examined, 13 as follows: 43 km. S Ciudad Victoria, 1; 70 km. [by highway] S Ciudad Victoria, and 6 km. W of [Pan-American] highway [at El Carrizo], 3; 70 km. [by hwy.] S Victoria and 2 km. W El Carrizo, 9.

Remarks.—These colorful squirrels were taken in thick timber and brush, and locally are referred to as "ardilla pinta" or "ardilla colorada." One female obtained on January 22 is black. Local hunters state that these squirrels are most active early in the morning and late in the afternoon. Two squirrels were seen in copulation on January 19.

Sciurus negligens Nelson

Little Gray Squirrel

Sciurus negligens Nelson, Proc. Biol. Soc. Washington, 12:147, June 3, 1898. (Type from Alta Mira, Tamaulipas, Mexico.)

Specimens examined, 17 as follows: 70 km. [by highway] S of Ciudad Victoria and 6 km. W of the [Pan-American] highway [at El Carrizo], 5; 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo, 12.

Remarks.—Referred to as "ardilla chica" locally, these squirrels were most frequently seen in the dense forest of the lower elevations. Active both in trees and on the ground, these animals were reported as being destructive to corn crops. Females taken in January were lactating.

Heterogeomys hispidus concavus Nelson and Goldman

Hispid Pocket Gopher

Heterogeomys hispidus concavus Nelson and Goldman, Proc. Biol. Soc. Washington, 42:148, March 30, 1929. (Type from Pinal de Amoles, Queretaro, Mexico.)

Specimens examined, 5 as follows: 70 km. [by highway] S Ciudad Victoria and 5 km. W El Carrizo, 4; 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo, 1.

Remarks.—These gophers have been compared with specimens of *H. h. hispidus* from Veracruz (5 km. N Jalapa and 4 km. WNW Fortin) and with specimens of *H. h. concavus* from San Luis Potosì (Xilitla and vicinity and 3 mi. NW Pujal); the latter were ex-

amined through the courtesy of Dr. George H. Lowery, Jr., of the Museum of Zoology at Louisiana State University. These five specimens are assigned to *H. h. concavus* and resemble in every way this subspecies except: slightly smaller, somewhat darker, and skull with lambdoidal crest less inclined forward. In the latter feature, the single skull available seems to resemble most closely that of *H. h. hispidus.* Unfortunately, all but one skull, that of a subadult female, were destroyed in the field.

This is the first known record of this genus in Tamaulipas and the most northern locality from which specimens have been taken. At this latitude, the gopher appears to be restricted to the humid belt on the east face of the Sierra Madre Oriental. These large gophers were difficult to trap by ordinary means; Schaldach got two by using large-sized Macabee traps but the others were taken at night either with the aid of a dog or by natives with slingshots.

Liomys irroratus texensis Merriam

Spiny Pocket Mouse

Liomys texensis Merriam, Proc. Biol. Soc. Washington, 15:44, March 5, 1902. (Type from Brownsville, Cameron County, Texas.)
Liomys irroratus texensis Goldman, N. Amer. Fauna, 34:59, September 7, 1911.

Specimens examined, 15 as follows: 7 km. S and 2 km. W San Fernando, 8; 36 km. N and 10 km. W Ciudad Victoria, 1 km. E El Barretal, on Río Purificacíon, 1; 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo, 6.

Remarks.—Most of these mice were taken in densely vegetated fallow fields, where both grass and brush were found. Many of the mice were captured at their burrow openings, some of which were found to be plugged and others not plugged.

Reithrodontomys fulvescens intermedius Allen

Fulvous Harvest Mouse

Reithrodontomys mexicanus intermedius Allen, Bull. Amer. Mus. Nat. Hist., 7:136, May 21, 1895. (Type from Brownsville, Cameron County, Texas.)
Reithrodontomys fulvescens intermedius Howell, N. Amer. Fauna, 36:47, June 5, 1914.

Specimen examined, 1 from 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo.

Baiomys taylori taylori (Thomas)

Pygmy Mouse

Hesperomys (*Vesperimus*) *taylori* Thomas, Ann. and Mag. Nat. Hist., ser. 5, 19:66, January, 1887. (Type from San Diego, Duval County, Texas.)
Baiomys taylori Mearns, Mamm. Mex. Bound., Bull. 56:381, April 13, 1907.

Specimens examined, 2 from 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo.

Remarks.—Specimens were captured in runways in dense grass and weeds at the edge of a corn field.

Peromyscus leucopus texanus (Woodhouse)

White-footed Mouse

Hesperomys texana Woodhouse, Proc. Acad. Nat. Sci. Philadelphia, 6:242, 1853. (Type probably from the vicinity of Mason, Mason County, Texas.)
Peromyscus leucopus texanus Osgood, N. Amer. Fauna, 28:127, April 17, 1909.

Specimens examined, 8 as follows: 7 km. S and 2 km. W San Fernando, 1; 12 km. N and 4 km. W Ciudad Victoria, 2; 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo, 4.

Peromyscus ochraventer new species

Brown-bellied Wood Mouse

Type.—Female, adult, skin and skull; no. 36958, Univ. Kansas Mus. Nat. Hist.; 70 km. [by highway] S Ciudad Victoria and 6 km. W of the [Pan-American] highway [at El Carrizo], Tamaulipas, Mexico; 12 January 1950; obtained by William J. Schaldach, Jr., original no. 566.

Range.—Known only from the type locality; probably found in other localities along the humid, east face of the Sierra Madre Oriental in Tamaulipas.

Diagnosis.—Size medium (see measurements); upper parts near Ochraceous Tawny (capitalized color terms after Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912), brighter on sides and duller on back; cheeks, sides of neck, shoulders and upper forelegs lighter, between Ochraceous Buff and Ochraceous Orange; eye ring dark; underparts light Cinnamon Buff, breast patch brighter; ears dusky, sparsely covered with hairs colored like back; feet white; tail scaly in appearance, indistinctly bicolored with short dark hairs above and short pale hairs below; skull without beaded or ridged supraorbital border; rostrum expanded anteriorly with sides almost parallel; teeth with strongly developed outer accessory cusps on the first and second upper molar teeth; anteriormost loph (parastyle-protoconule of Goldman, N. Amer. Fauna, 43:11, September 23, 1918) of the first upper molar large, almost as broad as greatest breadth of tooth.

Comparisons.—*Peromyscus ochraventer* has been compared with *P. difficilis* (specimens from Veracruz), *P. boylei* (Veracruz), *P. banderanus* (Guerrero), *P. mexicanus* (Veracruz), *P. furvus* (Veracruz), and *P. latirostris* (San Luis Potosí). From *P. difficilis*, *P. ochraventer* differs in having underparts distinctively brownish, rostrum expanded anteriorly with sides almost parallel, anteriormost loph of the first upper molar larger, and auditory bulla smaller. From *P. boylei*, *P. ochraventer* differs in having underparts distinctively brownish, tail less distinctly bicolored, rostrum expanded anteriorly with sides almost parallel, and anteriormost loph of the first upper molar larger. From *P. banderanus*, *P. ochraventer* differs in having underparts distinctively brownish, tail less distinctly bicolored, rostrum expanded anteriorly with sides almost parallel,

anteriormost loph of the first upper molar larger, auditory bulla smaller, and in lacking a beaded or ridged supraorbital border. From *P. mexicanus, P. ochraventer* differs in having underparts distinctively brownish, tail not irregularly blotched with dusky, rostrum expanded anteriorly with sides almost parallel, anteriormost loph of the first upper molar larger, and in lacking a beaded or ridged supraorbital border. From *P. furvus* and *P. latirostris, P. ochraventer* differs in being smaller, having underparts distinctively brownish, tail not irregularly blotched with dusky, rostrum proportionately shorter, and interpterygoid space relatively narrower.

Remarks.—Peromyscus ochraventer is considered to be a distinct species showing little evident relationship with other Mexican *Peromyscus.* In the shape of the skull, especially the anterior expansion of the rostrum, *P. ochraventer* seems to be related to *P. furvus* and *P. latirostris,* a series of the latter being made available for examination by Dr. George G. Lowery, Jr., of the Museum of Zoology at Louisiana State University. However, the rostrum of these two larger species is proportionately longer than the rostrum of *P. ochraventer.* In size, coloration and most cranial features, *P. ochraventer* resembles *P. mexicanus,* although the absence, instead of presence, of a supraorbital bead or ridge, the almost parallel-sided, instead of more pointed, rostrum and the larger, instead of smaller, interiormost loph of the first upper molar in *P. ochraventer* are well-marked differences. The baculum of *P. ochraventer* is much shorter with a proportionately heavier base and shaft than the baculum of *P. mexicanus mexicanus* (from Veracruz) and *P. m. saxatilis* (from Costa Rica). The geographic range of *Peromyscus ochraventer* is not known to meet that of *P. mexicanus;* the nearest place to the type locality of *P. ochraventer* from which *P. mexicanus* has been taken is at Xilitla approximately 225 kilometers to the southward in San Luis Potosí (Dalquest, Occ. Papers Mus. Zool., Louisiana State Univ., No. 28:8, July 10, 1950).

The brown coloring on the underparts is a distinctive feature of *P. ochraventer;* in adults this color differs in shade. In some specimens patches of whitish hair give the tail a splotched appearance. Eleven of the twenty-eight skulls and lower jaws examined have bone eroded away from around the cheek-teeth exposing part of the roots. Most of the fully adult animals have this condition. One adult female, no. 36959, has the upper third molar on the right side missing, possibly as a result of bone erosion.

These mice were taken in junglelike forest, in rocks and adjacent to logs. Schaldach writes that "Their burrows go back under the

large limestone blocks, and each burrow where I caught a mouse has a pile of excavated earth, like a tiny gopher mound." The trapping area was at an elevation of approximately 2800 feet on the steep sides of a small hill on top of which the field camp was situated. Schaldach indicated that this locality was transitional between arid tropical and humid tropical conditions. On January 13, 1950, a female taken was lactating and had five recent placental scars; another taken the same day also had five placental scars.

Measurements.—Average and extreme measurements of seven adult males and six adult females of *P. ochraventer* from the type locality are, respectively, as follows: Total length, 238.0 (227-249), 236.5 (226-248); length of tail, 124.4 (117-127), 122.2 (116-128); length of hind foot, 25.6 (24-26), 25.5 (25-26); length of ear from notch, 20.9 (20-21), 20.7 (20-21); greatest length of skull, 31.0 (30.6-31.9), 30.8 (30.5-31.0); basilar length, 23.3 (22.7-23.8), 23.4 (23.0-23.9); zygomatic breadth, 15.1 (14.6-15.7), 15.0 (14.9-15.2); post palatal length, 10.6 (10.5-10.9), 10.9 (10.5-11.2); interorbital breadth, 4.7 (4.5-4.9), 4.7 (4.6-4.8); mastoidal breadth, 12.8 (12.4-13.2), 12.8 (12.6-12.9); length of nasals, 11.6 (10.8-12.0), 11.6 (11.2-11.7); length of shelf of bony palate, 4.7 (4.5-4.8), 4.6 (4.5-4.7); length of palatine slits, 6.3 (6.0-6.5), 6.2 (6.0-6.4); length of diastema, 8.2 (8.0-8.5), 8.2 (8.1-8.4); alveolar length of upper molariform tooth-row, 4.4 (4.3-4.6), 4.4 (4.3-4.5).

Specimens examined, 28, from the type locality.

Oryzomys couesi aquaticus Allen

Coues Rice Rat

Oryzomys aquaticus Allen, Bull. Amer. Mus. Nat. Hist., 3:289, June 30, 1891. (Type from Brownsville, Cameron County, Texas.)
Oryzomys couesi aquaticus Goldman, N. Amer. Fauna, 43:39, September 23, 1918.

Specimens examined, 2 as follows: 36 km. N and 10 km. W Ciudad Victoria, 1 km. E El Barretal, on Río Purificacíon, 1; 70 km. [by highway] S Ciudad Victoria and 6 km. W of the [Pan-American] highway [at El Carrizo], 1.

Remarks.—The specimens, all immatures, are slightly darker than topotypes of *O. c. aquaticus,* seemingly tending toward the darker *O. c. peragrus* Merriam to the southward. These records of occurrence extend the known range of this subspecies approximately 210 miles to the southward and increase the possibility of continuous distribution between *O. c. aquaticus* and *O. c. peragrus.*

The male obtained south of Ciudad Victoria was taken on January 12, by William J. Shaldach, Jr., 200 yards within the tunnel of a mine at an elevation of approximately 2600 feet. This was in the Sierra Gorda, which is a part of the Sierra Madre Oriental.

Oryzomys rostratus rostratus Merriam

Rice Rat

Oryzomys rostratus Merriam, Proc. Washington Acad. Sci., 3:293, July 26, 1901. (Type from Metlaltoyuca, Pueblo, Mexico.)

Specimen examined, 1 from 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo.

Remarks.—This immature male is paler than specimens of *O. r. rostratus* from the state of Veracruz. This locality extends the known range of this species northward a distance of approximately 100 miles. Previously it had been recorded from only as far north as Alta Mira, Tamaulipas (Goldman, N. Amer. Fauna, 43:54, September 23, 1918). This specimen was trapped on February 16 in a rodent runway in dense grass in a fallow cane field.

Oryzomys fulvescens engraciae Osgood

Fulvous Rice Rat

Oryzomys fulvescens engraciae Osgood, Jour. Mamm., 26:300, November 14, 1945. (Type from Hacienda Santa Engracia, northwest of Ciudad Victoria, Tamaulipas, Mexico.)

Specimens examined, 5 from 70 km. [by highway] S Ciudad Victoria and 2 km. E El Carrizo.

Remarks.—These specimens are referred to *O. f. engraciae* on the basis of their pale color and narrow interorbital space. They were taken in runways in dense grass in fallow cane fields.

Sigmodon hispidus toltecus (Saussure)

Hispid Cotton Rat

[*Hesperomys*] *toltecus* Saussure, Revue et magasin de zoologie, ser. 2, 12:98, 1860. (Type from mountains of Veracruz, Mexico.)
Sigmodon hispidus toltecus Bailey, Proc. Biol. Soc. Washington, 15:110, June 2, 1902.

Specimens examined, 23 as follows: 36 km. N and 10 km. W Ciudad Victoria, 1 km. E El Barretal, on Río Purificacíon, 1; 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo, 22.

Remarks.—Among named kinds of *Sigmodon* this series most closely approaches *S. h. toltecus* to the southward. The specimens are slightly lighter in color of the upper parts than are examples of this same subspecies from 8 km. NW of Potrero, Veracruz, but in other ways are similar. The single specimen from 36 km. N and 10 km. W Ciudad Victoria is a skull only, but seems closest to *S. h. toltecus.* As is often the case with collections of *Sigmodon,* this series contains mostly immatures.

Cotton rats were found abundantly in cultivated areas. Local

farmers stated that these rats were destructive to sugar cane by girdling the stems one and one-half inches above the ground.

Neotoma micropus micropus Baird

Baird Wood Rat

Neotoma micropus Baird, Proc. Acad. Nat. Sci. Philadelphia, p. 333, April, 1855. (Type from Charco Escondido, Tamaulipas, Mexico.)

Specimens examined, 2 from 7 km. S and 2 km. W San Fernando.

Neotoma angustapalata new species

Tamaulipan Wood Rat

Type.—Male, subadult, skin and skull; No. 36976, Univ. Kansas Mus. Nat. Hist.; 70 km. [by highway] S Ciudad Victoria and 6 km. W of the [Pan-American] highway [at El Carrizo], Tamaulipas, Mexico; 14 January 1950; obtained by William J. Schaldach, Jr., original no. 578.

Range.—Known only from the type locality; probably found in other localities along the humid, east face of the Sierra Madre Oriental in Tamaulipas.

Diagnosis.—Size large (see measurements); upper parts dusky brown, paler on sides, individual hairs on middle of back tipped with black or with Light Pinkish Cinnamon (capitalized color term after Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912); head grayer especially on cheeks; underparts dusky (dark bases of white-tipped hairs exposed), hairs on throat and inguinal region of adult specimen white to base; outside of legs dusky gray; tail scaly in appearance and sparsely covered with short, blackish hairs above and short, whitish hairs below; skull with auditory bulla large; external auditory meatus large; palatine region narrow; sides of interpterygoid fossa concave and broadly excavated near posterior end of molariform tooth-rows.

Comparison.—*Neotoma angustapalata* has been compared with *N. torquata* (specimens from Veracruz and Puebla), *N. navus* (Coahuila), *N. mexicana* (New Mexico), *N. micropus* (Tamaulipas), *N. albigula* (Coahuila), *N. ferruginea* (Jalisco), and *N. distincta* (from published description in Goldman, N. Amer. Fauna, 31:64, October 19, 1910). *Neotoma angustapalata* differs from *N. micropus* and *N. albigula* in having a deep, instead of a shallow, anterointernal reentrant angle on the first upper molar and seems to belong to the *N. mexicana* group of wood rats. *Neotoma angustapalata* differs from *N. navus, N. mexicana, N. torquata,* and *N. ferruginea* in larger size, darker underparts, tail with sparse, short hairs and scaly appearance, more broadly concave sides of interpterygoid fossa at posterior end of molariform tooth-rows, larger external auditory meatus, and narrower palatine breadth. *Neotoma angustapalata* differs from the description of *N. distincta* in having a faintly bicolored tail, no ochraceous pectoral band, broadly concave sides to interpterygoid fossa, and narrower palatine breadth.

Remarks.—*Neotoma angustapalata* is represented by two specimens; the type and another specimen, an adult male, no. 37062, with skin and broken skull. The description takes into account

both of these specimens. The most significant characteristics of *N. angustapalata* are its scaly-appearing tail with short, sparse hairs, dusky underparts, broadly concave sides of the interpterygoid fossa at the posterior end of molariform tooth-rows, and the narrow palatine breadth. Among named kinds of *Neotoma*, the newly named species most closely resembles *N. torquata* and *N. distincta;* however, it is geographically widely separated from these two species. *Neotoma navus* of southeastern Coahuila is the only other member of the *N. mexicana* group in northeastern Mexico.

These wood rats were taken in rocks and crevices at the base of a small hill in thick vegetation growing in deep humus. Schaldach termed the trapping site as "arid tropical tending toward humid tropical".

Measurements.—The subadult, male holotype measures as follows: Total length, 325; length of tail, 154; length of hind foot, 36; length of ear from notch, 29; basilar length (of skull), 33.9; zygomatic breadth, 22.1; interorbital breadth, 5.7; length of nasals, 15.2; length of incisive foramina, 8.7; length of palatal bridge, 8.5; least breadth of palate between first upper molars, 2.7; greatest breadth of interpterygoid space, 4.1; alveolar length of upper molariform tooth-row, 9.6. The adult, male, no. 37062, measures as follows: Total length, 380; tail vertebrae, 195; hind foot, 42; ear from notch, 31; interorbital breadth (of skull), 6.4.

Specimens examined, 2, from the type locality.

Rattus rattus subsp.

Black Rat

Specimens taken, 2 from 70 km. [by highway] S Ciudad Victoria and 6 km. W of the [Pan-American] highway [at El Carrizo].

Mus musculus subsp.

House Mouse

Specimen examined, 1 from 12 km. N and 4 km. W Ciudad Victoria.

Nasua narica tamaulipensis Goldman

Coati

Nasua narica tamaulipensis Goldman, Proc. Biol. Soc. Washington, 55:80, June 25, 1942. (Type from Cerro de la Silla, near Monterrey, Nuevo Leon, Mexico.)

Specimen examined, 1 from 70 km. [by highway] S Ciudad Victoria and 2 km. W El Carrizo.

Remarks.—Several bands of coatis were observed in the vicinity of the village of El Carrizo. One skull of a male was obtained.

Transmitted June 8, 1951.

A New Pocket Gopher (Genus Thomomys) From Wyoming and Colorado

BY

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A New Pocket Gopher (Genus Thomomys) from Wyoming and Colorado

By

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Among small mammals accumulated, from Wyoming, in the Museum of Natural History of the University of Kansas, specimens of the wide-spread species *Thomomys talpoides* are abundantly represented. Subspecific names are available for most of these, but specimens from the Sierra Madre Mountain Range of Wyoming and Colorado prove upon comparison to pertain to an heretofore unnamed subspecies which may be described and named as follows:

Thomomys talpoides meritus new subspecies

Type.—Male, adult, skull and skin, no. 25628 Mus. Nat. Hist. Univ. Kansas; from 8 mi. N and 19½ mi. E Savery, 8800 ft., Carbon County, Wyoming; obtained on July 19, 1948, by George M. Newton; original no. 4.

Range.—Sierra Madre Mountain Range of southern Wyoming and northern Colorado.

Diagnosis.—Size small (see measurements); color dark, upperparts in worn pelage of July darker than (near, *n*) Raw Umber (capitalized terms are of Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912) and in fresh pelage of August between (near, 16′) Prout's Brown and Mummy Brown; skull small; relative to basilar length, skull narrow across rostrum, zygomata and mastoids; nasals short and posteriorly truncate; premaxillae extending behind nasals; temporal lines faint and divergent posteriorly.

Comparisons.—From *Thomomys talpoides rostralis* (North Platte River Valley, SW of Saratoga, Wyoming), the subspecies to the east and south, *T. t. meritus* differs in: Lesser size, darker color, smaller and slenderer skull. The slenderness is especially noticeable in the breadth across the zygomata, mastoids, and rostrum. From *Thomomys talpoides clusius* (topotypes), the subspecies to the north and west, *T. t. meritus* differs in: Color much darker; rostrum longer; skull narrower across mastoids and zygomata; tympanic, and also mastoid, bullae smaller. Resemblance to *T. t. clusius* is shown in the narrowness of the skull interorbitally and in the shortness of the tooth-row.

Remarks.—The specimens of *Thomomys* from Wyoming on which the name *T. t. meritus* is based were obtained by Mr. E. Lendell Cockrum and his associates with the thought that intergradation might be shown between *T. t. rostralis* to the east and *T. t. clusius* to the west. The animals showed instead, that there was a subspecies differing from each of the two mentioned subspecies in small size, dark color and slenderness of skull. Acknowledgment of assistance

with field work is made to the Kansas University Endowment Association.

Measurements.—Average and extreme measurements of seven adult males and five adult females, from the type locality, are as follows: Total length, ♂ 204 (193-226), ♀ 207 (193-210); length of tail, 56 (46-68), 56 (50-63); length of hind foot, 27.6 (26-30), 27.4 (27-28); basilar length, 30.7 (29.0-33.0), 30.1 (29.5-30.7); zygomatic breadth, 20.4 (18.9-21.6), 19.5 (18.8-20.0); least interorbital breadth, 6.2 (5.8-6.6), 6.1 (5.9-6.3); mastoidal breadth, 17.9 (16.9-18.5), 17.2 (16.7-17.6); length of nasals, 13.7 (12.4-14.7), 13.2 (12.8-13.9); breadth of rostrum, 7.0 (6.5-7.5), 6.9 (6.7-7.3); length of rostrum, 16.3 (15.3-17.5), 15.8 (15.3-16.1); alveolar length of maxillary toothrow, 7.1 (6.9-7.3), 7.1 (6.8-7.5).

Specimens examined.—Total number 26 and unless otherwise indicated in the Museum of Natural History of the University of Kansas.

Wyoming.—*Carbon County:* Savery (8 mi. N and 19½ mi. E, 8800 ft., 12; 7 mi. N and 17 mi. E, 8300 ft., 1; 6 mi. N and 12½ mi. E, 8400 ft., 1; 6 mi. N and 13½ mi. E, 8400 ft., 2; 6 mi. N and 14½ mi. E, 8350 ft., 1; 5 mi. N and 3 mi. E, 6800 ft., 1; 4 mi. N and 8 mi. E, 7800 ft., 7300 ft., 3; 4 mi. N and 10 mi. E, 7800 ft., 3) 24.

Colorado—*Routt Co.* ?: Elkhead Mts., 20 mi. SE Slater, 2 (U. S. B. S.).

Museum of Natural History, University of Kansas, Lawrence. Transmitted October 20, 1951.

24-1359

A New Name for the Mexican Red Bat

BY

E. RAYMOND HALL

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A New Name for the Mexican Red Bat

By

E. RAYMOND HALL

When Gerrit S. Miller, Jr., published his "Revision of the North American Bats of the Family Vespertilionidae" (N. Amer. Fauna, 13:1-140, 3 pls., 39 figs. in text, October 16, 1897), the red bat, *Lasiurus borealis,* was known from the southern half of Mexico but he did not know that the hoary bat, *Lasiurus cinereus,* also occurred there. Therefore, the name *A*[*talapha*]. *mexicana* Saussure (Revue et magasin de zoologie, 13 (ser. 2): 97, March, 1861) that clearly pertained to a lasiurine bat, almost certainly from southern Mexico, was applied by Miller (*op. cit.*: 111) to the red bat as a subspecific name. Subsequently, the hoary bat, *Lasiurus cinereus cinereus* (Beauvois 1796), was shown to occur in southern Mexico. For example, an adult male *L. c. cinereus* was obtained on May 6, 1945, by W. H. Burt from the Barranca Seca in the State of Michoacán (see Hall and Villa, Univ. Kansas Publ., Mus. Nat. Hist., 1:445, December 27, 1949). Because two, instead of only one, species of *Lasiurus* are now known to occur in the general part of Mexico visited by Saussure, it has seemed desirable to re-examine the application of the name *A*[*talapha*]. *mexicana* Saussure which that naturalist proposed along with a description as follows:

Long inrolled tail; femoral patagium as in the vespertilios. Teeth $\frac{4}{2}$, $\frac{1}{1}$, $\frac{4}{5}$ or $\frac{5}{5}$.

A. mexicana Valida. Molar teeth $\frac{4}{5}$. Head and throat with a tendency toward fulvous, mouth and chin dark. Ears small and rounded, black, exterior at the base dark and hairy, interior with the anterior margin and an area in the middle yellow-haired. Back chestnut, above [hairs apically] grayish, below [hairs lower down] reddish, everywhere marbled with white. Tibiae, feet and the femoral patagium reddish marbled with white. Venter dusky-gray, with hairs at the apex and on the breast whitish, on the abdomen with tendency toward fulvous. White spot on humerus. Wings black; underneath the arm and the superior half of the wing yellow-haired. Above [on the upper side] with three whitish spots on the base of the thumb and fifth finger situated in the angle of the elbow. —Forearm length 53 mm. [Above is translation from the Latin original.]

As may readily be seen by comparing specimens of *L. borealis* and *L. cinereus* from Mexico (or also from any place in North America north of Mexico), the description by Saussure applies to the hoary bat (*Lasiurus cinereus*) and not to the red bat (*Lasiurus borealis*).

Accordingly, the name *A[talapha]. mexicana* Saussure 1861 falls as a synonym of *Lasiurus cinereus cinereus* (Beauvois 1796); if the hoary bat of the southern end of the Mexican table land should prove to be subspecifically separable, the name *Lasiurus cinereus mexicanus* would be available for it.

The Mexican red bat, thus, is left without a name, and for it I propose

Lasiurus borealis ornatus new subspecies

Type.—Skin (8492 U. S. Nat. Mus.), and corresponding skull (37578 U. S. Nat. Mus.), sex not recorded on the label; Penuela, Veracruz; 20 February 1866; obtained by F. Sumichrast.

Range.—Approximately the southern two-fifths of Mexico; exact limits of range unknown.

Diagnosis.—Resembles *Lasiurus borealis teliotis* (H. Allen) but feet, interfemoral membrane, and under side of wings much less hairy.

Comparisons.—From *L. b. teliotis,* which occurs to the northwest, *L. b. ornatus* differs in the restricted peripheral distribution of the fur (see Miller, N. Amer. Fauna, 13:112, October 16, 1897). From *Lasiurus borealis frantzii* (Peters), which occurs to the southward, *L. b. ornatus* differs in longer forearm (41 *versus* 37); upper parts lighter rufescent or chestnut, the back being only lightly overlaid with this color; underparts washed with lighter buff, the basal tone plumbeous, instead of blackish; skull larger (see Goldman, Proc. Biol. Soc. Washington, 45:148, September 9, 1932).

Transmitted October 20, 1951.

24-1360

Taxonomic Notes on Mexican Bats of the Genus Rhogeëssa

BY

E. RAYMOND HALL

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Taxonomic Notes on Mexican Bats of the Genus Rhogeëssa

BY

E. RAYMOND HALL

Five skins with skulls of *Rhogeëssa,* collected by J. R. Alcorn in the states of Sonora and Nayarit of western Mexico, were recently received at the Museum of Natural History of the University of Kansas. Two other specimens of the same genus, collected by Walter W. Dalquest in the state of Veracruz of eastern Mexico, also are in the Museum of Natural History. With the aim of applying names to these bats they were compared with materials in the United States National Museum (including the Biological Surveys collection) where there are approximately the same number of Mexican specimens of *Rhogeëssa* as are in the Museum of Natural History.

The three kinds of *Rhogeëssa* named from Mexico are as follows: *R. parvula* from the Tres Marias Islands off the west coast of Nayarit; *R. tumida* from Mirador, Veracruz, on the eastern slope of the Republic; and *R. gracilis* from Piaxtla, Puebla, on the southern end of the Mexican Plateau.

Of *Rhogeëssa gracilis* Miller (N. Amer. Fauna, 13:126, October 16, 1897) only three specimens are known; two are from Piaxtla, Puebla, and the third is from the Isthmus of Tehuantepec. Only the specimen from the Ishtmus has a complete skull. The broken skull of the holotype is partly separated from the skin of the head and in such a manner as to reveal the teeth. The skull of the holotype seems to be broader (relative to its length) across the mastoids and posterior parts of the zygomata than in *R. tumida* or than in *R. parvula.* My comparisons indicate that *Rhogeëssa gracilis* has larger (longer and wider) ears than *R. parvula* and *R. tumida* and that it is specifically distinct from the two last mentioned kinds.

The two other nominal species from Mexico, *R. parvula* and *R. tumida,* were named and described by Harrison Allen (Proc. Acad. Nat. Sci. Philadelphia, 1866: 285 and 286, respectively) on the basis of three specimens in the United States National Museum. Two were from the Tres Marias Islands and were the basis of the name *R. parvula;* the third was from Mirador, Veracruz, and was the basis

of the name *R. tumida.* These specimens seem to have been preserved in alcohol. I have examined the skulls of two of these. One (U.S.N.M., new number 37329, old number 7842) is alleged to be the paratype of *R. parvula* and the other (U.S.N.M., 84021) is alleged to be the holotype of *R. tumida.* In the glass vial containing skull No. 84021, there is a label in the handwriting of Gerrit S. Miller, Jr., bearing the following information: "In the orig. descr. the number of this sp. is said to be 8195. This is an error. Specimen catalogued 3.1.98 G.S.M. Jr." On the back of a second label in the skull vial there is written, "There is no doubt that this is the type skull. It was returned by H. A. with no. given in orig. descr. G.S.M. Jr." In the catalogue of the U. S. National Museum there is the statement that the type of *Rhogeëssa tumida* was collected by H. A. Grayson.

The name *Rhogeëssa parvula* was based on two specimens (Smithsonian Institution Nos. 7841 the type and 7842, in alcohol, collected by Col. Grayson in the Tres Marias Islands off the west coast of Mexico. The type seems never to have been returned from the Academy of Sciences of Philadelphia to the U. S. National Museum in Washington, D. C., and cannot (in 1951) be found in Philadelphia or anywhere else. The skull, but no other part, of the second specimen is in the United States National Museum under the catalogue number 37329 (old No. 7842). The skull has been broken in two through the interorbital region but is glued together.

Of *R. tumida,* no additional specimen has been saved, so far as I know, from the type locality, Mirador, Veracruz.

Of *R. parvula,* Nelson and Goldman, on May 19, 1897, on María Madre Island, saved in alcohol an additional specimen (92413 U.S.N.M.) from which J. Biggs, Preparator at the National Museum, in 1951, removed and cleaned the skull. In small size and in all other features, the skull of 92413 closely resembles those of specimens saved by Alcorn from the adjoining mainland of Mexico in Sonora and Nayarit. The pelage of the upper parts of 92413 could be described as "of a light greyish-brown at basal third, fawn-chestnut-brown at apical two-thirds" which are the words that H. Allen (*op. cit.*: 285) used to describe the pelage of his *R. parvula.* The external measurements of 92413 are: total length, 60; length of tail, 25; length of hind foot, 5.5; and ear from notch, 11.0. The first two measurements are slightly smaller than the corresponding measurements of any other specimen seen. Nevertheless, the measurements (tail, 30.5; hind foot, 5.3 [after H. Allen, orig. descr.]) of the

holotype of *R. parvula,* also from the Tres Marias Islands, show that it was as large as no. 39724 from the adjoining mainland (see table 1).

According to the original descriptions, *R. parvula* and *R. tumida* differ in size, *R. parvula* being the smaller. As may be seen from table 1, the alleged type of *R. tumida* and the alleged paratype of *R. parvula* indicate the opposite! All specimens obtained since the time of the original descriptions, as may be seen by inspecting table 1, support the correctness of the original descriptions. Therefore, and also because of the other information presented above, I am inclined to the opinion that the holotype of *R. tumida* and the paratype of *R. parvula* have been switched; each now is associated with the name and data, at least for locality, of the other.

Other opinions are that *Rhogeëssa* from the Tres Marias Islands average smaller than *Rhogeëssa* of the adjoining mainland of western Mexico but not enough smaller to warrant subspecific separation of the two. Specimens from places geographically intermediate between the geographic ranges, as now known, of *R. parvula* and *R. tumida* probably will reveal intergradation between the two kinds, which, therefore, should stand as subspecies of a single species.

As understood now, the Mexican *Rhogeëssa* are as follows:

Rhogeëssa parvula parvula H. Allen

1866. *Rhogeëssa parvula* H. Allen, Proc. Acad. Nat. Sci. Philadelphia, p. 285, type from Tres Marias Islands.

Range.—Tres Marias Islands and western mainland of Mexico from Alamos, Sonora, south to San Blas, Nayarit.

Rhogeëssa parvula tumida H. Allen.

1866. *Rhogeëssa tumida* H. Allen, Proc. Acad. Nat. Sci. Philadelphia, p. 286, type from Mirador, Veracruz.

Range.—From Boca del Río, Veracruz, in eastern México, southward over México and Central America into Panamá.

Rhogeëssa gracilis Miller.

1897. *Rhogeëssa gracilis* Miller, N. Amer. Fauna, 13:126, October 16, 1897, type from Piaxtla, Puebla.

Range.—Known only from the type locality and the Isthmus of Tehuantepec.

Transmitted November 30, 1951.

TABLE 1.—MEASUREMENTS OF RHOGEËSSA FROM MEXICO

No.	Sex	Date	Locality	Forearm	Greatest length of skull including teeth	Condylobasal length (not including teeth)	Length of upper tooth-row, C1–M3	Zygomatic breadth	Mastoid breadth	Breadth across upper molars
			Rhogeëssa parvula parvula							
* 92413	?	May 19, 1897	Maria Madre Island	26.0	11.25	10.5	4.1	.....	6.1	4.7
7841	?	.....	lost specimen—Tres Marias Ids.	27.4	.....	.....	.....	.....	.....	.....
84021	.....	.....	alleged type of *R. tumida*	.....	11.8	10.9	4.3	.....	6.2	4.9
24853	♀	May 7, 1948	W side Alamos, Sonora	29.5	11.7	10.8	4.2	7.8	6.5	4.8
24854	♀	May 7, 1948	W side Alamos, Sonora	29.0	11.4	10.6	4.4	7.6	6.1	4.9
39723	♂	Aug. 5, 1950	½ mi. E San Blas, Nayarit	27.2	12.2	11.5	4.5	7.9	6.5	5.1
39724	♂	Aug. 5, 1950	½ mi. E San Blas, Nayarit	27.3	11.7	10.7	4.2	7.4	6.4	4.8
39725	♀	Aug. 7, 1950	½ mi. E San Blas, Nayarit	28.0	12.0	10.9	4.4	.....	6.9	5.1
			Rhogeëssa parvula tumida							
29886	♂	Dec. 8, 1948	Boca del Rio, 10 ft., Veracruz	28.7	12.7	11.9	4.63	8.4	6.9	5.6
19231	♀	Oct. 6, 1946	Rio Blanco, 20 km. W Piedras Negras, Veracruz	30.5	13.2	12.4	4.8	.....	7.0	5.6
37329	?	.....	alleged paratype of *R. parvula*	.....	12.3	11.3	4.68	.....	6.5	5.4
73269	♀	Jun. 12, 1895	Santo Domingo, Oaxaca	32.6	13.5	12.5	5.0	8.5	6.9	5.65
170858	♂	Oct. 7, 1910	LaTuxpana, Champoton, Campeche	26.7	12.4	11.3	4.5	7.6	6.5	4.9

* The first three specimens and the last three are in the United States National Museum; the others are in the University of Kansas Museum of Natural History.

Comments on the Taxonomy and Geographic Distribution of Some North American Woodrats (Genus Neotoma)

BY

KEITH R. KELSON

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Comments on the Taxonomy and Geographic Distribution of some North American Woodrats (genus Neotoma)

BY

KEITH R. KELSON

While I was preparing distribution maps of the various species and subspecies of the genus *Neotoma,* a number of inconsistencies pertaining to the geographic distribution of these animals were found in the literature. These inconsistencies are, for the most part, the result of failure of later students of the group to take cognizance of earlier published records. Accordingly, certain specimens, which have been previously recorded in the literature, have been examined in an attempt to resolve the more obvious of the inconsistencies. The study here reported upon was aided by a contract between the Office of Naval Research, Department of the Navy, and the University of Kansas (NR 161-791). Unless otherwise indicated, catalogue numbers of the specimens are of the United States National Museum, most of the specimens being in the Biological Surveys Collection of the United States Fish and Wildlife Service. Grateful acknowledgment is made to the persons in charge of the collections for their permission to examine the specimens under their care.

Neotoma floridana illinoensis A. H. Howell

1910. *Neotoma floridana illinoensis* A. H. Howell, Proc. Biol. Soc. Washington, 23:28, March 23.

Goldman (N. Amer. Fauna, 31:23, October 19, 1910) referred specimens of *Neotoma floridana* from Washington, Mississippi, to the subspecies *N. f. rubida.* Subsequently, Lowery (Occas. Papers Mus. Zool., Louisiana State Univ., 13:246, November 22, 1943), with more material from that general area at his disposal, designated specimens from northern Louisiana as *Neotoma floridana illinoensis* and, by so doing, cast some doubt on the identification of the material from Washington, Mississippi.

The six specimens from Washington, Mississippi, in the Biological Surveys Collection of the United States National Museum have been compared with near-topotypes of *N. f. rubida* from Houma, Louisiana, and with specimens from several localities within the range of *N. f. illinoensis* including the type and topotypes. *N. f. illinoensis* averages less rich in color than *N. f. rubida* and has a bicolored, not unicolored tail, posteriorly emarginate (rather than concave) palate, and markedly longer upper molar tooth-row. In color, the specimens from Washington are intermediate between *N. f. illinoensis* and

N. f. rubida. In possessing bicolored tails they resemble *N. f. illinoensis;* in cranial characters, the specimens are referable to *N. f. illinoensis* except that in No. 46126 the posterior border of the palate is concave and not emarginate, and in No. 46391 the upper molar tooth-row is short. Although they appear to be intergrades, as a whole the series is best referred to *Neotoma floridana illinoensis* A. H. Howell.

The three specimens from McGehee, Arkansas, which were referred by Goldman (*loc. cit.*) to *N. f. rubida* seem to me better referred to *N. f. illinoensis.* In the shape of the posterior border of the palate they are variable, the one full-grown adult being in that respect like *N. f. illinoensis;* in shape of the zygomatic arches they are intermediate between *N. f. rubida* and *N. f. illinoensis;* in color, especially in the bicolored nature of the tails, they are like *N. f. illinoensis* to which I provisionally refer them.

Neotoma floridana osagensis Blair

1939. *Neotoma floridana osagensis* Blair, Occas. Papers Mus. Zool., Univ. Michigan, 403:5, June 16.

When Blair (Occas. Papers Mus. Zool., Univ. Michigan, 403:5, June 16, 1939) named *Neotoma floridana osagensis,* he stated that the range of the subspecies probably included those parts of Missouri, Arkansas, and Texas that adjoin eastern Oklahoma and eastern Kansas. In an attempt to ascertain more precisely the eastern and southern limits of the geographic range of *N. f. osagensis,* I have examined the following specimens in the Biological Surveys Collection: *Arkansas:* Batesville, 2; Cotter, 3; Delight, 2; Pettigrew, 2; Rich Mountain, 8; Womble, 1. *Missouri:* Marble Cave, 4; Stone Co., 3. *Texas:* Marysville, Cooke Co., 1; and in the collection of the U. S. National Museum, the following: *Texas:* Gainesville, Cooke Co., 1. All of these except the specimen from Marysville were previously referred by Goldman (N. Amer. Fauna, 31:26, October 19, 1910) to the subspecies *N. f. attwateri.* On the basis of the length of the upper molar tooth-row (longer than in *N. f. attwateri*), heavy molar teeth, and darker color, they seem best referred, among named subspecies, to *N. f. osagensis* although No. 34875, listed as from Stone County, Missouri, is brighter in color and has a slightly shorter upper molar tooth-row than does "typical" *N. f. osagensis.*

The specimen from Texarkana, Texas, No. 118852, referred by Goldman (*op. cit.* :23) to *N. f. rubida* is an intergrade between *N. f. illinoensis* and *N. f. osagensis.* The skull is heavier and broader than in comparable specimens of *N. f. illinoensis;* the molar teeth are broad as in *N. f. osagensis,* the rostrum and nasals are as long as in much larger specimens of *N. f. illinoensis* and longer than in *N. f. osagensis,* the tail (collector's measurement, 208 mm.) is longer than in *N. f. osagensis* and the same as in *N. f. illinoensis.* In color the specimen is indistinguishable from comparable specimens of *N. f. illinoensis.* To me the specimen seems best assigned to *Neotoma floridana illinoensis* although it could, with almost equal propriety, be referred to *N. f. osagensis.*

Neotoma lepida californica Price

1894. *Neotoma californica* Price, California Acad. Sci., ser. 2, 4:154, May 9.
1938. *Neotoma lepida californica,* vonBloeker, Proc. Biol. Soc. Washington, 51:201, December 23.

When vonBloeker (Proc. Biol. Soc. Washington, 51:201-204, December 23, 1938) named *Neotoma lepida petricola* and reported on *Neotoma lepida californica,* he did not account for three specimens, Nos. 150878-150880, in the Biological Surveys Collection, from Fremont Peak, Gabilan Range, California, which Goldman (N. Amer. Fauna, 31:44, October 19, 1910) had referred to *Neotoma [lepida] intermedia.* Fremont Peak is north of the geographic range ascribed to *N. l. petricola,* west of that of *N. l. californica,* and appears to be separated by parts of the ranges of those two subspecies from the range (as now restricted on the north) of *N. l. intermedia.* I have examined the specimens from Fremont Peak and find that, in total length, length of tail, basilar length, length of nasals, depth of skull, length of palatal bridge, and length of incisive foramina they are best referred to *Neotoma lepida californica.* For knowledge of the diagnostic features of *N. l. californica* and *N. l. petricola,* I have relied principally on the diagnoses, comparisons, and measurements of those subspecies as given by vonBloeker (*op. cit.*).

Neotoma fuscipes perplexa Hooper

1938. *Neotoma fuscipes perplexa* Hooper, Univ. California Publ. Zool., 42:224, March 1.

Goldman (N. Amer. Fauna, 31:91, October 19, 1910) referred two dusky-footed woodrats from Pacheco Pass, California, to the subspecies *Neotoma fuscipes annectens.* When Hooper (Univ. California Publ. Zool., 42 (4):213-246, March 1, 1938) reported on the geographic variation of the species, he made no mention of these two specimens. From a geographic standpoint, they would be expected to be referable to Hooper's (*op. cit.* :24) newly-named subspecies *Neotoma fuscipes perplexa.* I have examined the specimens, Nos. 150454 and 150869. They more closely resemble *N. f. perplexa* than *N. f. annectens* in light color of upper parts, light color of feet, proportionately shorter and broader rostrum, and laterally expanded incisive foramina. It is on this basis that the specimens are here referred to *Neotoma fuscipes perplexa.* Because of the paucity of my material, I have been unable to apply Hooper's criteria (*op. cit.*) for distinguishing between *N. f. annectens* and *N. f. perplexa.*

Neotoma cinerea pulla Hooper

1940. *Neotoma cinerea pulla* Hooper, Univ. California Publ. Zool., 42:411, May 17.

Hooper's (Univ. California Publ. Zool., 42 (9):407-424, May 17, 1940) report on the geographic variation in bushy-tailed woodrats left unaccounted for certain specimens reported by Goldman (N. Amer. Fauna, 31:1-124, October 19, 1910). In his report, Hooper (*op. cit.*) named two subspecies, *Neotoma cinerea alticola* and *Neotoma cinerea pulla,* and revived the name *Neotoma [cinerea] acraia* (Elliot), and, by so doing, greatly restricted the geographic ranges formerly ascribed to other subspecies, notably *Neotoma cinerea occidentalis* and *Neotoma cinerea cinerea.* Some of the specimens reported by Goldman (*op. cit.*) are from localities between the geographic ranges of neigh-

boring subspecies as those ranges were known to Hooper by the specimens he examined. In order to determine more precisely the geographic ranges of certain subspecies of bushy-tailed woodrats, I have examined pertinent specimens in the U. S. National Museum Biological Surveys Collection, including most of those reported by Goldman (*op. cit.*) and the identity of which was left in doubt by Hooper's more recent work.

Two specimens, Nos. 140419 and 140420, from Orick, California, are inseparable from near-topotypes of *Neotoma cinerea pulla* and differ from specimens obtained from several localities throughout the range of *N. c. occidentalis* (to which one of the Orick specimens was referred by Goldman, *op. cit.* :102), in smaller size, white feet (not dusky), longer nasals, and more widely-spreading zygomatic arches. A specimen, No. 166883, from Empire, Oregon, also assigned by Goldman (*loc. cit.*) to *N. c. occidentalis*, proves to be an intergrade between *N. c. fusca* and *N. c. pulla*. The dark dorsal color is as in *N. c. fusca*, but the small size of both skin and skull, less angular skull, relatively long nasals, and nearly white ventral surface of the tail show the specimen to be best referred to *N. c. pulla*. It is readily distinguishable from *N. c. occidentalis* by its white feet, small size, and dark color. Specimens Nos. 206508 and 206370, from Port Orford, still farther south on the Oregon coast, are almost typical of *N. c. pulla*. Although I have not located the two specimens from Requa, California, recorded by Goldman (*loc. cit.*) as *N. c. occidentalis*, I suspect that they, too, will prove to be referable to *N. c. pulla*.

Specimens from Naylox, Klamath Co., Oregon (Nos. 80582 and 80583), Burney (Nos. 147826 and 147827), and Brownell (No. 139297), California, are intergrades between *N. c. alticola* and *N. c. pulla*. They more closely resemble the latter, to which they are referred, in darker color, smaller size, smoother, more lightly constructed skulls, proportionately longer tails, and smaller molar dentition. In size of tympanic bullae and length (relative to the basilar length) of the palatal bridge, they are intermediates between *N. c. alticola* and *N. c. pulla*. None of them is referable to *N. c. occidentalis* to which they were assigned by Goldman (*loc. cit.*) although the specimens from Naylox, as might be expected, do show an approach to that subspecies in some characters.

I agree with Hooper (*op. cit.* :411) that specimens from Fort Klamath, Oregon, are approximately intermediate in their characters between *N. c. pulla* and *N. c. occidentalis* and follow him in assigning them to *N. c. pulla*. Specimens from Crater Lake, north of Fort Klamath, are more clearly referable to *N. c. occidentalis* to which subspecies they were allocated by Goldman (*op. cit.*).

Neotoma cinerea alticola Hooper

1940. *Neotoma cinerea alticola* Hooper, Univ. California Publ. Zool., 42: 409, May 17.

Specimens Nos. 204659, 204660 and 204661, from Bend, Oregon, are intergrades between *N. c. occidentalis* and *N. c. alticola*. They are here referred to the latter subspecies, which they more nearly resemble in larger size, proportionately shorter tail, and longer palatal bridge. They seem to be intermediate in the size of the tympanic bullae, and to resemble *N. c. occidentalis* in short molar tooth-row and weak molar dentition. Their color furnishes no clue to assist in their allocation, because in northern and central Oregon the two sub-

species differ but slightly in this respect, and even so, the difference is appreciated only when the specimens are compared *en masse*.

Farther north, a specimen, No. 78677, from the John Day River [near its mouth], Oregon, also is an intergrade between *N. c. occidentalis* and *N. c. alticola* and is here referred to *N. c. alticola*. It possesses the smaller skull and smaller molar teeth of *N. c. occidentalis*, but in other diagnostic features more closely resembles *N. c. alticola*. Two specimens from The Dalles, west of the mouth of the John Day River, are referred to *N. c. occidentalis*. The adult, No. 57139, is readily separated from *N. c. alticola*, but the other, No. 89049, a juvenile, as an individual would be unassignable to subspecies.

The one specimen, No. 80584, a young adult, from Tule Lake, Oregon, assigned by Goldman (*loc. cit.*) to *N. c. occidentalis* is to me unassignable to subspecies on the basis of its morphological characters. I here assign it to *N. c. alticola* on geographic grounds only.

As a result of the study of these specimens and others whose localities of capture are in the same region, but not geographically marginal, I think that (1) in Oregon, *N. c. occidentalis* is restricted to the Cascade Range north of the Klamath Valley, (2) *N. c. occidentalis* does not occur in California, and (3) *Neotoma cinerea pulla* is the name best applied to the coastal populations from Empire, Oregon, southward to Orick, California.

Specimens of bushy-tailed woodrats from Arco and Big Butte, Butte Co., Idaho, were referred by Goldman (*op. cit.* :102) to *Neotoma cinerea occidentalis*. Later, Davis (The Recent Mammals of Idaho, Caxton Printers, April 5, 1939, p. 301), I think on geographic grounds, referred the same material to *N. c. cinerea*. I have examined these specimens, No. 23323/30782 from Arco and Nos. 23919/31324 and 23920/31325 from Big Butte, and find them referable to *Neotoma cinerea alticola* on the basis of dark color, large tympanic bullae, and closed (or almost so) sphenopalatine vacuities. They differ in these particulars from specimens of *N. c. cinerea*. I have examined also specimens of *Neotoma cinerea* from the Lost River Mountains near Arco and Birch Creek, not far distant, and agree with both Goldman and Davis that the specimens from those places are referable to *N. c. cinerea*.

Neotoma cinerea cinnamomea J. A. Allen

1895. *Neotoma cinnamomea* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 7:331, November 8.
1942. *Neotoma cinerea cinnamomea* Warren, The mammals of Colorado, Univ. Oklahoma Press, p. 221.

Hooper (Jour. Mamm., 25 (1):415, February 15, 1944) and Warren (The mammals of Colorado. Univ. Oklahoma Press, 1942, p. 221) independently recognized the name *Neotoma cinerea cinnamomea* J. A. Allen as applicable to the populations of bushy-tailed woodrats from southwestern Wyoming. Goldman (*op. cit.* :104) had earlier arranged the name as a synonym of *Neotoma cinerea orolestes*. I have examined specimens from Cokeville; Fontanelle; Fort Bridger; Green River, 4 mi. NE Linwood (Utah); and Beaver Creek, 4 mi. S Lonetree, all in Wyoming, and agree with Hooper and Warren that specimens from southwestern Wyoming are sufficiently different from *N. c. orolestes*, *N. c. cinerea*, *N. c. acraia*, and *N. c. alticola*, the surrounding subspecies, to warrant nominal recognition as *Neotoma cinerea cinnamomea*. The specimen, No. 22494/30044, from Fort Bridger, Wyoming, that was referred to *N. c.*

cinerea by Goldman (*op. cit.* :98) differs from *N. c. cinerea* in smaller size, light but rich color and larger tympanic bullae; in color it is darker (richer) than in topotypical *N. c. cinnamomea.* I tentatively, nevertheless, refer it to *N. c. cinnamomea.* A specimen (No. 29505, Carnegie Museum) from 8 mi. NE Craig, Moffat Co., Colorado, is the southernmost record of occurrence of *N. c. cinnamomea* known to me.

Neotoma cinerea acraia (Elliot)

1904. *Neotoma cinerea acraia* Elliot, Field Columb. Mus., Zool. Ser. 3:247, January 7.
1940. *Neotoma cinerea acraia* Hooper, Univ. California Publ. Zool., 42:413, May 17.

Hooper's (Jour. Mamm., 25 (1):415, February 15, 1944) revival of the name *cinnamomea* for bushy-tailed woodrats from southwestern Wyoming and my (Univ. Utah Biol. Ser., 11 (3):93, February 26, 1951) application of the name *Neotoma cinerea acraia* to animals from the central mountain ranges of Utah leave in doubt Davis' (*op. cit.* :301) earlier allocation of specimens from the east side of Bear Lake, Bear Lake Co., Idaho, to *Neotoma cinerea cinerea.* I have examined the pertinent specimens, Nos. 55181, 55381 and 55382, in the Biological Surveys Collection. On the basis of smaller size, smaller hind feet, less massive and less ridged skulls, and closed sphenopalatine vacuities, all particulars in which they differ from *N. c. cinerea* and resemble *N. c. acraia,* the specimens are here assigned to the latter subspecies. They differ from *N. c. cinnamomea* principally in color and from *N. c. alticola* in much lighter color, smaller size, smaller, smoother, and more lightly constructed skulls, and weaker molar dentition.

Goldman (*op. cit.* :98) referred specimens from Bright Angel Springs, Kaibab Plateau, Arizona, to *Neotoma cinerea cinerea.* Subsequently, Bailey (Nat. Hist. Bull., Grand Canyon Nat. Hist. Assoc., 1:14, June, 1935) referred animals from the Kaibab Plateau to *Neotoma cinerea orolestes.* The use of the name *N. c. acraia* (Kelson, *loc. cit.*) for animals from the central mountain ranges of Utah also leaves in doubt the nomenclatorial status of the bushy-tailed woodrats from the Kaibab Plateau. Specimens were examined in the Biological Surveys Collection, all from the Kaibab Plateau, as follows: Big Springs (Nos. 243120-243122), Bright Angel Spring (Nos. 161639-161641), and V. T. Park (Nos. 248994-248996). In possessing smaller skulls, closed sphenopalatine vacuities, and less angular (posteriorly) zygomatic arches, they differ from both *N. c. orolestes* and *N. c. cinerea* and resemble *Neotoma cinerea acraia* to which latter subspecies I refer them. Color, in this case, provides no clue to the identity of the specimens because they are slightly darker than in "average" specimens of *N. c. acraia* and are matched in this respect by many specimens of *N. c. orolestes,* including near-topotypes from Colorado.

Neotoma (Hodomys) alleni Merriam

Two species have been recognized in the subgenus *Hodomys, Neotoma alleni* Merriam and *Neotoma vetulus* (Merriam), but there seems to be intergradation between them and therefore they should be arranged as belonging to one species. Reasons for reducing the generic name *Hodomys* Merriam to subgeneric rank under the genus *Neotoma* Say and Ord are given by Burt and Barkalow (Jour. Mamm., 23 (3):295, August 14, 1942).

Evidence of the intergradation referred to above between the two nominal species is furnished by specimens in the Biological Surveys Collection from "near Ahuacana" [= La Huacana] in Michoacán, Puente de Ixtla in Morelos, and by the twelve specimens from the type locality (Acapulco, Guerrero) of *Neotoma alleni guerrerensis* (Goldman). In external measurements and in linear measurements of the skull, *N. a. guerrerensis* is intermediate between *N. alleni* and *N. vetulus* as Merriam (Proc. Acad. Nat. Sci. Philadelphia, 1894, pp. 225-252, 1 pl.. 5 figs. in text, September 24, 1894) knew them at the time of naming *Hodomys vetulus*. In the series of specimens of *N. a. guerrerensis* the feet vary from dark to light. The tail of an adult female from Puente de Ixtla, Morelos, is faintly bicolored instead of sharply bicolored as in *N. vetulus*, or unicolored as in *N. a. guerrerensis*. The specimen from Michoacán and those from Morelos are intermediate in ridging of the skull (for example, in upturned orbital border of the frontal) and in width across the posterior part of the frontals. Specimen No. 127527 from Puente de Ixtla has the interparietal shield as narrow as in *N. a. guerrerensis*, but in other individuals from the same place, the shield is variously wider; in some the shield is approximately as wide as in specimens from the type locality of *N. a. vetulus*. The alleged (by Merriam, *op. cit.*) difference in degree of expansion posteriorly of the mandible (if I correctly interpret Merriam's statement) is equaled by individual variation in each of several series of specimens. The specimens from Morelos, which are geographically intermediate between the heretofore recognized species, are morphologically intermediate in size of the anterointernal loop of M1 and in degree of division of the posterointernal loop of that tooth. The anteroexternal sulcus on m3 is no more pronounced in some specimens of *N. a. guerrerensis* than in specimens from the type locality of *N. a. vetulus*. Thus, each of the differential characters relied upon by Merriam (*op. cit.*) in giving full specific status to *Hodomys vetulus* and *Hodomys alleni* is found to be assignable to individual or geographic variation. I have sought in vain for additional characters that would permit the recognition of two full species. Consequently, the named kinds of the subgenus *Hodomys* should stand as follows:

NEOTOMA ALLENI ALLENI Merriam

1892. *Neotoma alleni* Merriam, Proc. Biol. Soc. Washington, 7:168, September 29. (Type from Manzanillo, Colima, Mexico.)

NEOTOMA ALLENI ELATTURA (Osgood)

1938. *Hodomys vetulus elatturus* Osgood, Zool. Ser., Field Mus. Nat. Hist., 20 (no. 35):475, December 31. (Type from Cuapongo, Guerrero, Mexico.)

NEOTOMA ALLENI GUERRERENSIS (Goldman)

Hodomys alleni guerrerensis Goldman, Jour. Washington Acad. Sci., 28 (11):498, November 15. (Type from Acapulco, Guerrero, Mexico.)

NEOTOMA ALLENI VETULA (Merriam)

1894. *Hodomys vetulus* Merriam, Proc. Acad. Nat. Sci. Philadelphia, 1894:236, September 24. (Type from Tehuacan, Puebla, Mexico.)

Examination of specimens convinces me that each of the above named kinds is a tenable subspecies. From Osgood's original description, I infer that Osgood, (*op. cit.*) thought that his animals from Chilpancingo were grayer than paratypes of *N. a. vetula* and had posteriorly narrower nasals "with their endings usually even with the premaxillae." These two features of the nasals vary

much in each of several series of the subgenus *Hodomys* and I think that Osgood had for comparison the two paratypes of *N. a. vetula* that have wider nasals posteriorly than do the holotype and other paratype (No. 53657); the two specimens last mentioned have the nasals much narrowed posteriorly. Examination of Osgood's hypodigm of *N. a. elattura* reveals that the subspecies is taxonomically separable from *N. a. vetula*. Tentatively I refer to *N. a. elattura* the specimen from La Huacana, Michoacán, and those from Puente de Ixtla, Morelos.

Subsequent to the time that Osgood prepared his manuscript describing and naming *N. a. elattura* and before its publication (December 31, 1938), Goldman (Jour. Washington Acad. Sci., 28 (11):498, November 15, 1938) named *N. a. guerrerensis*. To judge from the published records of occurrence, the latter subspecies occurs in the coastal lowlands of Guerrero. Because, to my knowledge, no comparisons heretofore have been made of *N. a. elattura* with *N. a. guerrerensis*, some doubt has existed as to whether the coastal populations of the species in Guerrero were subspecifically different from the inland populations in Guerrero. Osgood (*op. cit.* :476) stated that in *N. a. elattura* the posterior ends of the nasals usually terminate even with the premaxillary tongues and (p. 475) that the tail is bicolored. A study of the specimens upon which the name is based discloses that the holotype is unique; the paratypes differ from the holotype in that the paratypes have premaxillary tongues which, although variable in length, extend posterior to the nasals. The paratypes have also slightly less inflated tympanic bullae, and tails blackish-brown (not brownish-gray) above and more distinctly bicolored. The holotype came from Cuapongo, Guerrero, and the others from Chilpancingo. I am unable to locate Cuapongo on a map, but it is in the vicinity of Chilpancingo.

Through the courtesy of Miss Viola Schantz and Mr. C. C. Sanborn, I have been able to compare 6 specimens of *N. a. elattura* (Nos. 48475, 48476, 48471, 47446, 48469 and 48468, Chicago Nat. Hist. Mus.) taken in September and October at Chilpancingo, Guerrero, with 4 topotypes of *N. a. guerrerensis* (Nos. 70570, 70576, 70577 and 70580, USBS) obtained in January. Two (Nos. 48475 and 48469) of the Chilpancingo specimens have almost completed the molt to winter pelage dorsally. The comparison discloses that *N. a. elattura* differs from *N. a. guerrerensis* in smaller external measurements, smaller skull, greater interorbital width, more ridged and channeled skull interorbitally, grayer, duller and less rufescent color above, absence of a diffuse obsolete median dark stripe on the posterior half of the back, darker grayer underparts, bicolored (but not sharply so) tail sparsely clothed with short brownish gray hairs as opposed to unicolored tail clothed with longer coarse blackish hairs. The degree of difference between the two series indicates that the names *N. a. elattura* and *N. a guerrerensis* are currently applied to recognizably different subspecies. A specimen (No. 40170, KU), from 7 mi. S Tumbiscatio, 2700 ft., Michoacán, provides the westernmost station of record for *N. a. elattura* known to me.

Transmitted December 4, 1951.

The Subspecies of the Mexican Red-bellied Squirrel, Sciurus aureogaster

BY

KEITH R. KELSON

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The Subspecies of the Mexican Red-bellied Squirrel, *Sciurus aureogaster*

BY

KEITH R. KELSON

In his excellent taxonomic treatment of the tree squirrels of Mexico and Central America, Nelson (Proc. Washington Acad. Sci., 1:15-110, 2 pls., May 9, 1899) recognized three subspecies of red-bellied squirrels, *Sciurus aureogaster aureogaster* F. Cuvier, *Sciurus aureogaster hypopyrrhus* Wagler, and *Sciurus aureogaster frumentor* Nelson. In his lists of specimens examined, Nelson (*op. cit.* :42 and 44) assigned certain specimens from "mountains near Santo Domingo" and Guichicovi in Chiapas, and Catemaco in Veracruz, to *S. a. aureogaster,* and other specimens from the same localities to *S. a. hypopyrrhus.* I originally attempted to study (identify to subspecies) the series of animals from only three places, but it became evident that a more extensive study was indicated.

The locality whence the holotype of *Sciurus aureogaster aureogaster* was obtained is unknown. Because certain specimens from Altamira, Tamaulipas, closely resemble Cuvier's figure of the type, Nelson (*op. cit.* :41) subsequently designated Altamira as the type locality. Miniatitlan, Veracruz, was designated by Nelson as the type locality of *S. a. hypopyrrhus* because Wagler's description of the type of that subspecies fitted so well certain of Nelson's specimens from that place.

Sciurus a. hypopyrrhus was said by Nelson (*op. cit.* :43 and 44) to differ from *S. a. aureogaster* in darker color, thinner pelage, much stiffer and more shining dorsal hairs, slenderer tail with black predominating, larger and proportionately narrower skull with larger auditory bullae, each bulla being "slightly constricted just in front of middle." *Sciurus aureogaster* varies greatly in intensity of color and in color-pattern. Fully 30 per cent of the specimens examined are in some degree melanistic and approximately 20 per cent of them are completely so. Others are more or less brown; the brown dulls the usually rufous parts. In many specimens this brown is well distributed even in the otherwise grizzled areas; in some specimens it is evenly distributed and in others it is in patches. Indeed, scarcely any two "normally" colored specimens are alike. Typically, the intense rufous color characteristic of the underparts in both

S. a. aureogaster and *S. a. hypopyrrhus* is also present on the costal region and shoulders. Even this distribution of color is highly variable; some specimens (for example No. 23948 KU, from 3 km. E San Andres Tuxtla, Veracruz) show no rufous dorsally and others (for example No. 19307 KU, from 20 km. W Piedras Negras, Veracruz) have the rufous extending over the legs, sides, and almost all of the dorsum from the shoulders to the rump except (in some) for an interrupted median strip of grizzled gray. It is true that specimens from Miniatitlan are darker than those from Altamira, but this seems not to be significant taxonomically, because examination of series from other localities provides no evidence of geographic variation in color except, possibly, in the frequency of melanism. A series of 13 specimens (Univ. Kansas) from 7 and 8 km. WNW Potrero, Veracruz, for example, is quite as dark as topotypes of *S. a. hypopyrrhus* from Miniatitlan, although the localities of capture are approximately in the center of the geographic range of *S. a. aureogaster*. In short, there seems to be no way to distinguish *S. a. hypopyrrhus* from *S. a. aureogaster* on the basis of color. An unusual amount of variation exists, but it seems to occur at random. Fixing type localities of the two subspecies at the places of origin of certain specimens which in color fit the original descriptions is meaningless because selected specimens or series from almost any place in the geographic range of the species would qualify as approximate color-duplicates of the types.

My findings agree with those of Nelson in that skulls from Miniatitlan average longer and narrower than those from Altamira, but this seems not to be significant taxonomically because the series from Altamira is, to judge from the material I have seen, somewhat shorter and broader cranially than is "average" for the alleged subspecies *S. a. aureogaster*. For example, series from Metlaltoyuca in Puebla, 3 km. E Axtla in San Luis Potosí, 8 km. NW Potrero and 20 km. NW Piedras Negras in Veracruz, although obtained from localities well within the geographic range of *S. a. aureogaster* (as outlined by Nelson), all more closely resemble the "topotypes" of *S. a. hypopyrrhus* in cranial measurements than they do "topotypes" of *S. a. aureogaster*. Conversely, specimens from that part of the range of *S. a. hypopyrrhus* most remote from the range of *S. a. aureogaster* (Montecristo, La Venta, and Teapa, all in Tabasco) more closely approximate the Altamiran series in cranial size and proportions than they do the Miniatitlan material. Therefore, my data contradict the statement of Nelson (*loc. cit.*) that the skulls of *S. a. hypopyrrhus* are larger but proportionately narrower than those

of S. *a. aureogaster.* The constriction of the auditory bullae alluded to by Nelson as being present in S. *a. hypopyrrhus* is also present in S. *a. aureogaster,* occurring in both subspecies in varying degrees without correlation with geographic distribution.

Actually, the only concrete evidence of geographic variation that I can detect in these animals is a slight increase southwardly in the frequency and degree of melanism, a kind of variation that is unworthy of taxonomic recognition in this species. It seems best, then, to regard the name *Sciurus aureogaster hypopyrrhus* Wagler as a synonym of *Sciurus aureogaster aureogaster* F. Cuvier.

Nelson (*op. cit.* :45) stated that S. *a. frumentor* "Differs strikingly from typical *aureogaster* in having well-marked nuchal and rump patches of yellowish brown or rufous brown; the underparts gray or gray washed with rufous; tail heavier and more bushy; pelage softer. . . . Skull indistinguishable from that of typical *aureogaster.*" I have examined 22 specimens from Jico, 7 from Las Vigas (the type locality), and one from 3 km. E Las Vigas, all in Veracruz. These include the type and paratypes of S. *a. frumentor.* Part (probably 7 specimens) of the series from Jico was referred by Nelson (*op. cit.* :46) to S. *a. frumentor* and he thought, or knew, these specimens to have been taken *above* Jico. The remaining specimens labelled as from Jico were referred to S. *a. aureogaster.* I am unable to find fault with the characterization of S. *a. frumentor* insofar as color or skull are concerned. I cannot verify to my own satisfaction the presence of "heavier" and bushier tail and softer pelage. The characters considered to be diagnostic of S. *a. frumentor* are distributed in an interesting geographic pattern the genetic import of which is not wholly clear. One specimen (No. 23945 KU) of the two available from 3 km. SW San Marcos, Veracruz, a locality on the coast approximately 50 miles north of Las Vigas, is indistinguishable from topotypes of S. *a. frumentor* except for slightly lighter-colored grizzled parts. The second specimen (No. 23946 KU) from the same locality, although a subadult in worn pelage, shows the color and striking dorsal pattern of S. *a. frumentor* and the ventral color of S. *a. aureogaster.* The dorsal pattern of S. *a. frumentor* is found also in the three specimens from San Carlos and Plan del Río, Veracruz (Nos. 11082, 11083 and 8278), Chicago Nat. Hist. Mus., respectively. (The two specimens from San Carlos were referred to S. *a. frumentor* by Elliot, Field Columb. Mus., Zool. Ser., vol. 8, Publ. no. 115:128, February 9, 1907.) Nevertheless, although the essential morphological characters of S. *a. frumentor* occur sporadically in other populations, the

animals from the higher elevations above Jico and Las Vigas are notably homogeneous, differ collectively from surrounding populations, and occupy a logical geographic range. Therefore *S. a. frumentor* is retained as a tenable subspecies, and the animals from the vicinity of San Marcos, and from San Carlos and Plan del Río are

Fig. 1. Geographic distribution of *Sciurus aureogaster*.
1. *Sciurus aureogaster aureogaster.* 2. *Sciurus aureogaster frumentor.*

referred to *S. a. aureogaster.* Incidentally, Nelson (*op. cit.* :45) remarks that he saw no melanistic specimens of *S. a. frumentor.* This is not strange because melanistic specimens could not be identified anyway.

The names, absolute synonyms, and geographic ranges of the two subspecies of *Sciurus aureogaster* here recognized are as follows:

SCIURUS AUREOGASTER AUREOGASTER F. Cuvier

1829. *Sciurus aureogaster* F. Cuvier, Hist. Nat. Mammiferes, VI, livr. LIX, pl. with text.
1830. *Sciurus rafiventer* Lichenstein, Abhandl. K. Akad. Wiss., Berlin, p. 116 (1827).
1831. *Sciurus leucogaster* F. Cuvier, Suppl. d'Hist. Nat. Buffon, pp. 300, 301.
1831. *Sciurus hypopyrrhus* Wagler, Oken's Isis, pp. 510, 511.
1841. *Sciurus mustelinus* Audubon and Bachman, Proc. Acad. Nat. Sci. Philadelphia, pp. 100, 101.
1841. *Sciurus ferruginiventris* Audubon and Bachman, Proc. Acad. Nat. Sci. Philadelphia, p. 101.
1845. *Sciurus ferrugineiventris* Schinz, Synopsis Mamm., II, p. 14.
1855. *Sciurus hypoxanthus* (Lichenstein MS) Geoffroy, Voyage de la Venus, Zool. (text), pp. 158, 159 (on labels of squirrels from Berlin Museum, *fide* Nelson, Proc. Washington Acad. Sci., 1:38, May 9, 1899).
1855. *Sciurus chrysogaster* Giebel, Saugethiere, p. 650.
1867. *Macroxus aureogaster* Gray, Ann. and Mag. Nat. Hist., ser. 3, 20:423.
1867. *Sciurus hypopyrrhous* Gray, Ann. and Mag. Nat. Hist., ser. 3, 20:424.
1867. *Macroxus morio* Gray, Ann. and Mag. Nat. Hist., ser. 3, 20:424.
1867. *Macroxus maurus* Gray, Ann. and Mag. Nat. Hist., ser. 3, 20:425.
1887. *Sciurus rufiventris*? Rovirosa, La Naturaleza, 7:360 (1885-1886).
1897. *Sciurus leucops* Allen, Bull. Amer. Mus. Nat. Hist., 9:198.
1899. *Sciurus aureogaster hypopyrrhus* Nelson, Proc. Washington Acad. Sci., 1:42, May 9.

Range.—Eastern slope of Mexico from southern Tamaulipas southward to Tabasco and Chiapas. Marginal localities arranged clockwise beginning with the northernmost station of record are: *Tamaulipas:* Victoria; Altamira; down the coast to *Veracruz:* Coatzocoalcos; inland to *Tabasco:* Montecristo. *Chiapas:* Tumbala. *Oaxaca:* Mountains near Santo Domingo. *Veracruz:* Otatitlan; Orizaba; Jico; Jalapa. *Puebla:* Metlaltoyuca. *Hidalgo:* Sierra Encarnacion. *Querétaro:* Pinal de Amoles. *San Luis Potosí:* Valles. *Tamaulipas:* Forlón. Specimen No. 51383 Chicago Mus. Nat. Hist., labelled as from San Luis Potosí, in the State of the same name, does not represent, I suspect, a natural occurrence of the animal. Possibly the specimen was purchased there in the market, but was actually captured elsewhere.

SCIURUS AUREOGASTER FRUMENTOR Nelson

1898. *Sciurus aureogaster frumentor* Nelson, Proc. Biol. Soc. Washington, 12:154, June 3.

Range.—Higher elevations of the Cofre de Perote. Marginal localities, both in Veracruz, are: Above Las Vigas; Jico.

This report is based on the examination of 256 specimens representing the entire known geographic range of the species. I am indebted to H. E. Anthony, Remington Kellogg, C. C. Sanborn, and Stanley P. Young for the privilege of examining specimens in their charge. The study here reported upon was aided by a contract between the Office of Naval Research, department of the Navy, and

the University of Kansas (NR 161-791). The specimens in the University of Kansas Museum of Natural History were obtained by field work supported by the Kansas University Endowment Association.

Transmitted December 6, 1951.

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24-2174

Geographic Range of Peromyscus melanophrys, with Description of New Subspecies

BY

ROLLIN H. BAKER

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Geographic Range of Peromyscus melanophrys, with Description of New Subspecies

BY

ROLLIN H. BAKER

Peromyscus melanophrys is a large, long-tailed mouse which may well bear the common name of plateau mouse, because it occurs, for the most part, on the Mexican Plateau. There it inhabits arid and often rocky areas. Little has been added to our knowledge of the geographic variation and distribution of this mouse since 1909, when Osgood (1909:184-189) wrote an account of the species and summarized information available on the three recognized subspecies, *P. m. melanophrys* (Coues), *P. m. zamorae* Osgood, *P. m. consobrinus* Osgood, and a closely related species, *P. xenurus* Osgood. Specimens recently obtained from the Mexican states of Jalisco, Coahuila and Durango by field workers of the University of Kansas Museum of Natural History disclose the presence of two unnamed subspecies and that *P. xenurus* should be reduced to subspecific rank under *P. melanophrys*. While presenting the information in support of this taxonomic arrangement it seems appropriate to summarize our present knowledge of the geographic range of the entire species. I have not attempted a taxonomic study of the species as a whole or of the subspecies *P. m. melanophrys*, *P. m. zamorae* and *P. m. consobrinus*, and my comments concerning these three subspecies necessarily reflect those of Osgood (*loc. cit.*).

Grateful acknowledgment is made to those in charge of the Biological Surveys Collection of the United States National Museum for permitting me to examine comparative material including topotypes of *zamorae, consobrinus* and *xenurus*.

Capitalized color terms are those of Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912. Assistance with field work is acknowledged from the Kansas University Endowment Association. This study was aided also by funds available under terms of a contract between the Office of Naval Research, Department of the Navy, and the University of Kansas (NR 161-791).

Peromyscus melanophrys melanophrys (Coues)

1874. *Hesperomys* (*Vesperimus*) *melanophrys* Coues, Proc. Acad. Nat. Sci. Philadelphia, p. 181, December 15, type from Santa Efigenia, Oaxaca, Mexico.
1885. *Hesperomys melanophrys* True, Proc. U. S. Nat. Mus., 7:598, (1884).
1894. *Peromyscus leucurus* Thomas, Ann. and Mag. Nat. Hist., ser. 6, 14: 364, November, type from Tehuantepec, Oaxaca, Mexico.
1897. *P*[*eromyscus*] *melanophrys* Allen, Bull. Amer. Mus. Nat. Hist., 9:51, March 15.
1903. *Peromyscus leucurus gadovii* Thomas, Ann. and Mag. Nat. Hist., ser. 7, 11:484, May, type from San Carlos [= Yautepec], Oaxaca, Mexico.

Range.—Southern part of the Mexican Plateau, as far south as southern Chiapas. See figure 1. Marginal occurrences, in clockwise order, are: *Distrito Federal:* Contreras, 2600 m. (Hooper, 1947:51). *Puebla:* Chalchicomula (Osgood, 1909:186); Tehuacán, 1700 m. (Hooper, 1947:51). *Oaxaca:* Teotitlán, 950 m. (Hooper, 1947:51); 1 km. NNW Cuicatlán, 560 m. (29486 KU); San Miguel (Osgood, 1909:186). *Chiapas:* San Bartolomé (*ibid.*); San Vicente (*ibid.*). *Oaxaca:* "near" Tehuantepec (*ibid.*); Las Vacas (*ibid.*); "near" Totolapa (*ibid.*); San Bartolo [= Coyotepec] (*ibid.*). *Guerrero:* 15 mi. S Chilpancingo, 4500 ft. (Davis, 1944:397); Los Sabinos, 1210 m. (28475 KU); 14 mi. S and 1 mi. W Iguala, 2600 ft. (38637 KU).

Remarks.—*Peromyscus melanophrys melanophrys* is distinguished from *P. m. zamorae,* the subspecies to the northwest by: Color pale; skull small and slender; auditory bullae small; maxillary tooth-row short.

Specimens from the southern part of the range of *melanophrys* in Oaxaca and Chiapas have not been studied since Osgood did so in 1909. As indicated by Hooper (1947:51), intergradation between *melanophrys* and *zamorae* may occur in the vicinity of the Distrito Federal.

Peromyscus melanophrys zamorae Osgood

1904. *Peromyscus melanophrys zamorae* Osgood, Proc. Biol. Soc. Washington, 17:66, March 21, type from Zamora, Michoacán, Mexico.

Range.—Southcentral Mexico. See figure 1. Marginal occurrences, in clockwise order, are: *Hidalgo:* Zimapan (Osgood, 1909:187). *Michoacán:* Querendaro (*ibid.*); Zamora (Hall and Villa R., 1949:463).

Remarks.—*Peromyscus m. zamorae* is distinguished from *P. m. melanophrys* as explained under that subspecies and from *P. m. consobrinus,* the subspecies to the north and northwest, by: Color darker; cranium more inflated; nasals longer.

Peromyscus melanophrys consobrinus Osgood

1904. *Peromyscus melanophrys consobrinus* Osgood, Proc. Biol. Soc. Washington, 17:66, March 21, type from Berriozabel, Zacatecas, Mexico.

Range.—Northern part of the Mexican table-land. See figure 1. Marginal occurrences, in clockwise order, are: *Zacatecas:* 2 mi. ESE Troncosa, 7000 ft. (40079 KU). *San Luis Potosí:* Hacienda La Parada (Osgood, 1909:188); 2 mi.

NW Tepeyac, 3400 ft., 14 mi. N and 29 mi. W Ciudad del Maiz (40081 KU). *Guanajuato:* Silao (Osgood, 1909:188). *Zacatecas:* 3 mi. SW Jalpa, 4600 ft. (40080 KU). *Zacatecas:* Monte Escobedo (Osgood, 1909:188).

Remarks.—Characters distinguishing *P. m. consobrinus* from other subspecies are given under accounts of those subspecies.

FIG. 1. Geographic ranges of the subspecies of *Peromyscus melanophrys*.

1. *P. m. coahuiliensis*
2. *P. m. xenurus*
3. *P. m. consobrinus*
4. *P. m. micropus*
5. *P. m. zamorae*
6. *P. m. melanophrys*

Peromyscus melanophrys micropus new subspecies

Type.—Male, adult, skin and skull, No. 31760, Univ. Kansas Mus. Nat. Hist.; 3 mi. N Guadalajara, Jalisco, Mexico; 11 January 1949; obtained by J. R. Alcorn, original number 7402.

Range.—Eastern and central Jalisco, Mexico. See figure 1. Marginal occurrences, in clockwise order, are: *Jalisco:* 2 mi. NW Magdalena, 4500 ft. (33686 KU); 2 mi. ESE Tequila, 4000 ft. (33733 KU); 3 mi. N Guadalajara (31760 KU); 4 mi. NE Ocotlán, 5050 ft. (31768 KU).

Diagnosis.—Size small for the species; hind feet short; color pale, upper parts Ochraceous-Buff in adult male with worn teeth; skull small; alveolar length of maxillary tooth-row short.

Comparisons.—From topotypes of *Peromyscus melanophrys zamorae,* geographically adjacent to the south, *P. m. micropus* differs in: Color paler; hind foot shorter; skull smaller especially in basilar length, length of diastema, inflation of auditory bullae, length of maxillary tooth-row. From topotypes of *P. melanophrys consobrinus,* geographically adjacent to the north and east,

P. m. micropus differs in: Color darker, hind foot shorter; skull smaller in those measurements mentioned under comparisons with *P. m. zamorae* and also in the postpalatal length; nasals longer.

Remarks.—*Peromyscus melanophrys micropus* is characterized by its small size in most external and cranial measurements. In color it is intermediate betwen the paler *consobrinus* and the darker *zamorae*. One adult male with teeth much worn has a richer, brighter color on the upperparts. Osgood (1909:186) has previously alluded to the brighter color of older adults of this species. Immature specimens from eastern Jalisco (Nos. 31766-31768 from 4 mi. NE Ocotlán) are referred to *micropus* on the basis of their short maxillary toothrows, although in length of hind feet they approach *zamorae*. A male with unworn teeth, from Zacatecas (No. 40080 from 3 mi. SW Jalpa), is referred to *consobrinus* on the basis of large size. No well-defined pectoral spots are present on any of the specimens examined.

Osgood (*op. cit.* :188) lists 16 specimens from Atemajac, Jalisco, as *P. m. consobrinus*. Atemajac, according to Goldman (Smiths. Misc. Coll., 115:169, July 31, 1951), is three miles north of Guadalajara; perhaps it is the same place where Alcorn took the series on which this description is partly based.

Measurements.—Average and extreme measurements of the holotype and five topotypes, all with occlusal surfaces of cheek teeth worn almost flat, are: Total length, 264 (253-280); length of tail, 152 (143-160); length of hind foot, 26 (26-27); basilar length, 23.3 (22.8-23.8); least interorbital constriction, 4.6 (4.4-4.7); length of nasals, 11.4 (10.8-11.8); shelf of bony palate, 4.6 (4.3-4.7); palatine slits, 6.3 (6.0-6.4); diastema, 8.0 (7.9-8.2); postpalatal length, 11.4 (11.3-11.6); alveolar length of maxillary tooth-row, 4.4 (4.3-4.5).

Specimens examined.—Total, 47, from: *Jalisco:* 2 mi. NW Magdalena, 4500 ft., 8; 2 mi. ESE Tequila, 4000 ft., 8; 3 mi N Guadalajara, 12; Atemajac [= 3 mi. N Guadalajara], 16 (USBS); 4 mi. NE Ocotlán, 5050 ft., 3.

Peromyscus melanophrys xenurus Osgood

1904. *Peromyscus xenurus* Osgood, Proc. Biol. Soc. Washington, 17:67, March 21, type from Durango, Durango, Mexico.

Range.—Southeastern Durango. See figure 1. Marginal occurrences, in clockwise order, are: *Durango:* 3 mi. NNW Cuencame (40588 KU); 4 mi. W Durango (38634 KU).

Remarks.—Osgood based the name *Peromyscus xenurus* on two specimens taken by E. W. Nelson and E. A. Goldman at Durango in the state of Durango, Mexico. He stated in the original description that these mice resembled *Peromyscus melanophrys* and, in his revision of the genus *Peromyscus* (*op. cit.* :189), indicated that intergradation between *xenurus* and *melanophrys* might be found. Recently, Mr. J. R. Alcorn, field representative for the Museum of

Natural History, obtained three specimens from near the type locality (Nos. 38634-38636 from 4 mi. W Durango) and four from eastern Durango (Nos. 40588-40591 from 3 mi. NNW Cuencame). This new material from near the type locality agrees with Osgood's description. Comparison of specimens of *xenurus* with those of adjacent subspecies of *P. melanophrys* which have an equal amount of wear on the molar teeth shows that the length of the nasals in *xenurus* probably is a less diagnostic character than Osgood supposed. The hind feet of the newly collected, near-topotypes lack the dusky color, and no well-developed pectoral spot is present; Osgood's specimens were taken in July and Alcorn's material from near Durango was taken in June. Three of the four near-topotypes have the characteristically thin, white undertail stripe; however, those from near Cuencame have a wider, white undertail stripe resembling that of *melanophrys*. Other ways in which *xenurus* seems significantly different from adjacent subspecies of *melanophrys* are: Size smaller, postpalatal length of skull in relation to basilar length shorter, and cranium relatively narrower. The series from near Cuencame, in eastern Durango, reflects these characteristics and seems best referred to *xenurus*, although the specimens are intermediate in both size and color between *xenurus* and *melanophrys;* they seem to be intergrades and provide the basis on which *P. xenurus* is here arranged as a subspecies of the earlier named *Peromyscus melanophrys*.

Peromyscus melanophrys coahuiliensis new subspecies

Type.—Female, adult, skin and skull, No. 35019, Univ. Kansas Mus. Nat. Hist.; Gomez Farias, 6500 ft., Coahuila, Mexico; 20 November 1949; obtained by W. K. Clark, original number 1293.

Range.—Known only from desert areas of the Lower Sonoran Life-zone in southeastern Coahuila; probably found in similar country in other parts of southern Coahuila and in part of southwestern Nuevo Leon, northern San Luis Potosí, and northeastern Zacatecas. See figure 1. Marginal occurrences, in clockwise order, are: *Coahuila:* 17 mi. N and 8 mi. W Saltillo (36257 KU); 7 mi. S and 1 mi. E Gomez Farias (35019 KU); 2 mi. E and ½ mi. S La Ventura (33248 KU).

Diagnosis.—Size medium; color pale, upper parts Cinnamon-Buff in adult female with worn teeth; auditory bullae large.

Comparisons.—From topotypes of *Peromyscus melanophrys consobrinus*, geographically adjacent to the south, *P. m. coahuiliensis* differs in: Color paler; skull with auditory bullae larger, cranium generally less inflated, palatine slits averaging shorter and more expanded laterally. From topotypes of *Peromyscus melanophrys xenurus*, geographically adjacent to the west, *P. m. coahuiliensis* differs in: Size larger; color paler; skull larger with auditory bullae slightly larger; postpalatal length in relation to basilar length shorter; breadth of cranium across auditory bullae relatively narrower.

Remarks.—Specimens from Coahuila referred to this newly named subspecies of *Peromyscus melanophrys,* to my knowledge, constitute the northeasternmost records for this species. This large mouse was taken in rocky, desert situations where catclaw, yucca and various cacti predominate.

Characterized by pale color and large auditory bullae, *P. m. coahuiliensis* resembles both *P. m. consobrinus* occurring to the south and *P. m. xenurus* occurring to the southwest; the new subspecies seems to be closer to *consobrinus* in cranial characters and to *xenurus* in color. Specimens from the state of San Luis Potosí (Nos. 36817-36821 from 10 mi. NE San Luis Potosí and No. 40081 from 2 mi. NW Tepeyac, 3400 ft., 14 mi. N and 29 mi. W Ciudad del Maiz) are intermediate between *consobrinus* and *coahuiliensis* in color and cranial characters but are best referred to *consobrinus.* A well-developed pectoral spot is present only in the type of *coahuiliensis;* two other specimens from Coahuila have a faint indication of such a spot.

Measurements.—Measurements of specimens with a moderate amount of wear on their teeth—including the type and two males (No. 33248 from 2 mi. E and ½ mi. S La Ventura and No. 35020 from 8 mi. N La Ventura)—are, respectively, as follows: Total length, 273, 247, 235; length of tail, 149, 130, 122; length of hind foot, 27, 26, 26; basilar length, 24.8, 24.0, 24.4; least interorbital constriction, 4.9, 4.7, 4.6; length of nasals, 11.8, 10.3, 10.0; shelf of bony palate, 5.0, 4.6, 4.6; palatine slits, 6.1, 6.5, 6.3; diastema, 8.3, 8.1, 8.2; postpalatal length, 11.8, 11.5, 11.5; alveolar length of maxillary tooth-row, 4.7, 4.5, 4.7. Measurements of one adult male in which the occlusal face of each molar is worn almost flat (No. 36257 from 17 mi. N and 8 mi. W Saltillo) are, respectively, as follows: 269, 144, 28, 25.5, 4.9, 11.8, 4.9, 7.2, 9.2, 12.1, 4.5.

Specimens examined.—Total, 9, from: *Coahuila:* 17 mi. N and 8 mi. W Saltillo, 1; 7 mi. S and 1 mi. E Gomez Farias, 4; 8 mi. N La Ventura, 3; 2 mi. E and ½ mi. S La Ventura, 1.

LITERATURE CITED

Davis, W. B.
1944. Notes on Mexican mammals. Jour. Mamm., 25:370-403, 1 fig. in text, December 12.

Hall, E. R., and Villa R., B.
1949. An annotated check list of the mammals of Michoacán, Mexico. Univ. Kansas Publ., Mus. Nat. Hist., 1:431-472, 2 pls., 1 fig. in text, December 27.

Hooper, E. T.
1947. Notes on Mexican mammals. Jour. Mamm., 28:40-57, February 17.

Osgood, W. H.
1909. Revision of the mice of the American genus *Peromyscus.* N. Amer. Fauna, 28:1-285, 8 pls., 12 figs., April 17.

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A New Chipmunk (Genus Eutamias) from the Black Hills

BY

JOHN A. WHITE

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24-2175

A New Chipmunk (Genus Eutamias) from the Black Hills

BY

JOHN A. WHITE

Study of the chipmunks from the eastern Rocky Mountains and Great Plains reveals that the chipmunks from northeastern Wyoming and from South Dakota which Howell (N. Amer. Fauna, 52:55, November 30, 1929) referred to *Eutamias minimus borealis* actually belong to a heretofore unnamed subspecies which may be named and described as follows:

Eutamias minimus silvaticus new subspecies

Type.—Female, adult, skull and skin, No. 20050 Mus. Nat. Hist., Univ. Kansas; from 3 mi. NW Sundance, 5900 ft., Crook County, Wyoming; obtained on July 4, 1947, by H. W. Setzer; original No. 1692.

Range.—Bear Lodge Mountains in northeastern Wyoming and the Black Hills of South Dakota.

Diagnosis.—Size large (see measurements); general tone of upper parts drab; sides Ochraceous Buff (capitalized terms are of Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912); lateral stripes Fuscus Black washed with Ochraceous Tawny; ventral side of tail near (14′ *h*) Ochraceous Orange and fringed with black.

Comparisons.—From *Eutamias minimus pallidus* (specimens from Buffalo in Johnson County, Ivy Creek, Rockypoint, Middle Butte, and South Butte in Campbell County, all in Wyoming, and Harrison, Sioux County, Nebraska), the subspecies to the southward, westward, and northward, *E. m. silvaticus* differs in: General tone of upper parts markedly darker, more reddish and less grayish; dorsal stripes darker; crown markedly darker. External measurements, and measurements and characters of the skull of the two subspecies, do not differ significantly. Unless otherwise specified all comparative material is in the Museum of Natural History of the University of Kansas.

From *Eutamias minimus cacodemus* (topotypes in the United States National Museum), the subspecies to the southeastward, *E. m. silvaticus* differs in the same manner in which it differs from *E. m. pallidus,* but the degree of difference is greater because *E. m. cacodemus* is even paler than *E. m. pallidus.*

From *Eutamias minimus confinis* (specimens from 17½ mi. E and 4½ mi. S Shell, 8500 ft., Big Horn County, Wyoming), *E. m. silvaticus* differs in: General tone of upper parts darker, more reddish and less grayish; sides of rump more reddish and less grayish; underside of tail more tawny; skull distinctly longer and broader across zygomata.

From *Eutamias minimus borealis* (specimens from 1 mi. NW of junction of Irons Creek and Laird River; N side Muskwa River, 4 mi. W Ft. Nelson, 1200

ft.; E side Minaker River, 1 mi. W Trutch; Beatton River, 115 mi. S Ft. Nelson; 5 mi. W and 3 mi. N Ft. St. John; S side Toad River, 10 mi. S and 21 mi. E Muncho Lake; all in British Columbia; and from Assineau River, 1920 ft., 10 mi. E and 1 mi. N Kinuso, Alberta), *E. m. silvaticus* differs in: Under side of tail more reddish; dorsal stripes less blackish; sides slightly paler (less tawny); nasals distinctly shorter; skull distinctly shorter.

Measurements.—Average and extreme measurements of three adult males and 11 adult females of *E. m. silvaticus* from the type locality are, respectively, as follows: Total length, 190 (189-190), 207 (202-220); length of tail, 85 (81-90), 97 (82-105); length of hind foot, 31 (30-33), 32 (31-34); length of ear, 14 (13-16), 15 (14-17); weight, 45.7 (44.6-46.5), 55.7 (50.0-68.0); greatest length of skull, 32.0 (31.5-32.6), 32.3 (31.5-33.1); zygomatic breadth, 18.5 (18.5-18.5), 18.6 (18.2-19.0); least interorbital constriction, 6.9 (6.8-7.1), 7.0 (6.4-8.1); length of nasals, 9.4 (9.2-9.6), 9.6 (9.3-10.1).

Measurements of the type.—Total length, 206; length of tail, 90; length of hind foot, 32; length of ear, 15; weight, 59.3; greatest length of skull, 32.6; zygomatic breadth, 18.6; least interorbital constriction, 6.4; length of nasals, 9.3.

Specimens examined.—Total number, 28. Specimens from South Dakota are in the United States National Museum, and those from Wyoming are in the Museum of Natural History of the University of Kansas.

South Dakota: *Custer Co.:* Custer, 3; *Lawrence Co.:* Deadwood, 10.

Wyoming: *Crook County:* 3 mi. NW Sundance, 5900 ft., 14; 15 mi. ENE Sundance, 3825 ft., 1.

Acknowledgment is made of assistance, with the field work, received from the Kansas University Endowment Association.

Museum of Natural History, University of Kansas, Transmitted December 8, 1951.

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24-2175

A New Piñon Mouse (Peromyscus truei) from Durango, Mexico

BY

ROBERT B. FINLEY, JR.

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A New Piñon Mouse (Peromyscus truei) from Durango, Mexico

BY

ROBERT B. FINLEY, JR.

The extensive collection of Mexican mammals made by Mr. J. R. Alcorn for the University of Kansas Museum of Natural History contains fourteen piñon mice from lava rocks eight miles northeast of the city of Durango, Mexico. These mice are all much darker than the piñon mice, *Peromyscus truei gentilis*, of adjoining areas in Durango and Zacatecas and show a superficial resemblance to the widespread *P. t. gratus* which occurs 450 miles to the southeast. Morphological differences from *P. t. gratus*, as well as geographic considerations (see remarks), make desirable the recognition of the lava-dwelling piñon mice from Durango as a distinct subspecies.

All specimens examined of subspecies compared with the series of piñon mice from northeast of Durango are in the University of Kansas Museum of Natural History. Capitalized color names and designators are of Maerz and Paul, A Dictionary of Color, McGraw Hill Book Co., New York, 1930.

I wish to acknowledge generous financial aid from the Kansas University Endowment Association which made possible the field work by Mr. Alcorn in Mexico.

This heretofore unknown subspecies is characterized below and may be known as:

Peromyscus truei erasmus subsp. nov.

Type.—Mus. Nat. Hist., Univ. Kansas, no. 34417, young adult female, skin and skull; from eight miles northeast of Durango, 6200 feet, Durango, Mexico; collected 16 August 1949 by J. R. Alcorn, original number 10255.

Range.—Known only from the type locality.

Diagnosis.—Upper parts dark brownish gray (Smoke Brown, 16 A 2, to Biskra, 16 A 12), darkest between ears; lower sides suffused with dull orange buff (13 H 9 to 12 H 9); dark eye ring and black spot at base of vibrissae conspicuous; ears 95 to 100 per cent as long as hind foot; bullae round, greatly inflated; interparietal large, anterior margin curved or slightly sinuous, not bulging strongly forward laterally; rostrum short; nasals broad; braincase high and full; incisive foramina slightly pointed anteriorly; molars small, as in *P. t. gentilis.*

Measurements.—Measurements of 3 males and mean and extreme measurements of 11 females, all from the type locality, are, respectively, as follows:

total length, 192, 188 (incomplete), 196 (incomplete), 193 (188-209); length of tail, 102, 97 (broken), 97 (broken), 101 (94-114); length of hind foot, 22, 23, 23, 22.5 (22-23); length of ear, from notch, in flesh, 21, 22, 23, 21.5 (20-23); greatest length of skull, 27.4, 27.7, 27.9, 27.3 (26.5-28.3); basilar length, 20.2, 21.0, — (broken), 20.4 (19.6-21.2); greatest breadth of braincase, 12.8, 12.8, 13.3, 12.85 (12.4-13.4); least interorbital breadth, 4.4, 4.6, 4.6, 4.41 (4.2-4.6); length of nasals, 10.1, 10.3, 10.9, 10.3 (9.8-11.1); diastema, 6.6, 7.0, 7.1, 6.78 (6.3-7.2); length of incisive foramina, 5.6, 5.9, 6.0, 5.77 (5.5-6.0); length of palatal bridge, 3.8, 3.9, —, 3.96 (3.8-4.3); postpalatal length, 9.9, —, —, 9.7 (9.2-10.4); alveolar length of maxillary tooth-row, 4.1, 4.1, 4.4, 4.2 (4.1-4.4). All measurements are in millimeters.

Measurements of the type.—Total length, 189; length of tail, 95; length of hind foot, 22; length of ear, from notch (in flesh), 21; greatest length of skull, 26.9; basilar length, 20.3; greatest breadth of braincase, 13.0; least interorbital breadth, 4.4; length of nasals, 10.1; diastema, 6.6; length of incisive foramina, 5.5; length of palatal bridge, 3.9; postpalatal length, 9.8; alveolar length of maxillary tooth-row, 4.2.

Comparisons.—From *Peromyscus truei gentilis* (specimens from 5 mi. N Durango, Durango; 4 mi. W Durango, Durango; and 8 mi. N & 1 mi. W Sombrerete, Zacatecas), the subspecies of the surrounding region, *P. t. erasmus* differs in markedly darker coloration, sides and face less brightly washed with orange buff, dark eye ring and spot at base of vibrissae more conspicuous, higher incidence and greater extent of buffy pectoral spot. External measurements do not differ significantly. No consistent cranial differences were found.

From *Peromyscus truei gratus* (specimens from Pedregal de los Reyes, Distrito Federal, México) to the southeast, *P. t. erasmus* differs in slightly darker dorsal color, more inflated bullae, and less sinuous (not bulging so much forward laterally) anterior margin of interparietal.

From *Peromyscus truei gratus* (specimens from various localities in eastern Jalisco and western Michoacán) to the south, *P. t. erasmus* differs in slightly darker dorsal color, longer ears, and more inflated bullae.

From *Peromyscus truei truei* (specimens from 4 mi. N El Rito, Rio Arriba Co., New Mexico) to the northwest, *P. t. erasmus* differs in much darker color, shorter tail, shorter hairs on tail, smaller ears, shorter rostrum, wider nasals, and more pointed anterior ends of incisive foramina.

Remarks.—The tail of *P. t. erasmus* varies greatly in color, being either bicolor or unicolor, dark gray above and varying from white to dark gray below. The type has the tail dark gray above grading gradually on the sides to medium gray below. A buffy pectoral spot or band is present in about half of the adults examined, being most prominent in the type, which is also one of the darkest specimens in the series. The shape of the posterior edge of the bony palate is also variable, being convex, square, or concave; and the dorsal branches of the premaxillaries may terminate slightly anterior or slightly posterior to the posterior ends of the nasals. In the type the posterior palatal margin is concave and the dorsal branches of

the premaxillaries almost reach the ends of the nasals. *Peromyscus truei gratus* from Distrito Federal also shows high variability in all these characters.

Peromyscus truei erasmus is a dark race of the piñon mouse known from the west side of a rough area of dark lavas a few miles northeast of the city of Durango and closely surrounded by the light colored race, *P. t. gentilis,* known from outside the area of lava rocks. Specimens of *erasmus* from eight miles northeast of Durango are all conspicuously darker than 11 specimens of *gentilis* from five miles north of Durango and four miles west of Durango which are typical in color for *gentilis.* Although *erasmus* more nearly resembles in color *gratus,* in cranial characters and external measurements it shows closer relationship to *gentilis.*

Alcorn reported (verbal communication) that the type series of *erasmus* was collected on the west side of the Río de la Saucida in hills covered with broken lava rocks, cactus, and spiny shrubs. Some cottonwoods grow along the river, which is almost dry most of the time. East of the river is a flat plain or valley of adobelike soil a few miles wide beyond which extends a rough area of dark lavas. The approximate extent of the lava plain is indicated on World Aeronautical Chart, Lake Santiaguillo (521). The specimens of *gentilis* from five miles north of Durango and four miles west of Durango were collected on slopes of adobe soil covered with grasses, scattered junipers and low shrubs, this habitat being the lower eastern edge of the juniper-wooded slopes that rise westward to the Sierra Madre Occidental.

The available facts suggest that *P. t. erasmus* has evolved from *P. t. gentilis* by natural selection for concealing coloration on the dark lavas northeast of Durango, México. *P. t. erasmus* probably reaches its western limit close to the type locality.

Specimens examined.—Total 14, from the type locality.

Museum of Natural History, University of Kansas, Lawrence.

Transmitted January 21, 1952.

24-2794

An Annotated Checklist of Nebraskan Bats

BY

OLIN L. WEBB and J. KNOX JONES, JR.

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An Annotated Checklist of Nebraskan Bats

BY

OLIN L. WEBB and J. KNOX JONES, JR.

HISTORY

The first mention of bats in Nebraska possibly was by Harrison Allen, in his "Monograph of the Bats of North America" (1864:14, 20, 30, 35, 42), who listed *Nycticejus crepuscularis* [= *Nycticeius humeralis*], *Lasiurus borealis, Scotophilus carolinensis* and *Scotophilus fuscus* [both = *Eptesicus fuscus*], and *Scotophilus noctivagans* [= *Lasionycteris noctivagans*], as collected in "Nebraska" (then Nebraska Territory) by J. G. Cooper. Henry W. Setzer (in *litt.*) reports that none of the bats collected by Cooper now exists in the United States National Museum and that no data pertaining to any of them are available except that a single specimen of *Nycticeius humeralis* was traded to the British Museum in 1866. Cooper journeyed through parts of the present state of Nebraska in the summer and autumn of 1857 and, judging from Taylor's (1919:72-80) report of Cooper's travels, this was the only time he entered any part of Nebraska Territory. The writers are of the opinion that the specimens in question probably were collected in Nebraska; but since Allen listed no exact localities or dates of collection and since the specimens and data pertaining to them are not now available, we have not included them here as Nebraskan records.

In the first comprehensive account of Nebraskan mammals, Myron H. Swenk (1908:137-139) listed six kinds of bats, *Myotis evotis, Myotis californicus ciliolabrum* [= *Myotis subulatus subulatus*], *Lasionycteris noctivagans, Eptesicus fuscus, Lasiurus borealis,* and *Lasiurus cinereus,* as occurring within the state. Zimmer (1913: 665) recorded *Nyctinomus mexicanus* [= *Tadarida mexicana*] from Nebraska. Subsequently, Swenk (1915:854) reported *Myotis lucifugus lucifugus* in the state and three years later (1918:411) he reported *Eptesicus fuscus pallidus* for the first time. The report of *M. l. lucifugus* seemingly was not substantiated by any actual specimens. The addition of *Myotis volans interior* (Quay, 1948:181) brought to ten the number of species and subspecies of bats reported from the state.

In the present paper, *Myotis keenii septentrionalis, Myotis lucifugus carissima,* and *Pipistrellus subflavus subflavus* are reported

from Nebraska for the first time. Also, the first authentic record of *Myotis lucifugus lucifugus* is presented, along with additional information on previously reported species. A total number of 169 specimens from Nebraska was available for the present study. This includes almost all of the known specimens preserved in all collections as well as material obtained by us in the past six years.

Nebraska has no natural caves or caverns; however, there are two extensive man-made limestone caves near Louisville, in Cass and Sarpy counties, where four kinds of bats have been found. Two of these are here reported as new to Nebraska. The quarries, one on either side of the Platte River Valley, are in a horizontal stratum of limestone 40 feet in thickness, and are of the room and pillar type; that is to say, the stone has been quarried away leaving rooms having supporting pillars approximately every 50 feet. The average temperatures in summer and winter within these tunnels, recorded over a period of several years by the Ash Grove Lime and Portland Cement Company of Louisville, are 65° F. and 50° F. respectively. The Kiewit Stone Quarry, abandoned since 1936, is one-half mile west of Meadow, Sarpy County, and has one remaining entrance measuring approximately 30 by 30 feet. This quarry has an area of approximately one-fifth square mile and is usually flooded with several feet of water. The other man-made cave, known formerly as the National Stone Quarry, is one mile northeast of Louisville, Cass County. This quarry was abandoned in September, 1938, and until the winter of 1948-1949 had eight or nine entrances and two air shafts. It was approximately one-third square mile in area. All the openings to this quarry were covered in late 1949. Bats were first observed in the National Stone Quarry by one of us (Webb) as early as 1939, less than a year after operations in the quarry ceased.

METHODS AND ACKNOWLEDGMENTS

Records of Nebraskan bats are arranged in two categories; specimens examined and additional records. The latter refer to citations in the literature. Genera are arranged according to Simpson (1945:59, 60), and species are listed alphabetically under each genus. Specimens examined are in the personal collection of the authors unless otherwise indicated.

In connection with this study the authors acknowledge the assistance of Drs. Edson H. Fichter, Department of Biological Sciences, Idaho State College, and E. Raymond Hall and Rollin H. Baker, University of Kansas Museum of Natural History for critical assistance with the manuscript. We are indebted to Mr. Richard B. Loomis, University of Kansas, for aid in collecting specimens; to Dr. Henry W. Setzer, United States National Museum, for providing information on possible early Nebraskan records; and to Mr. Fred Brammer, Ash

Grove Lime and Portland Cement Company, Louisville, Nebraska, for information on, and permission to collect in, the quarries of that area. For the loan of specimens we are grateful to Dr. William H. Burt, University of Michigan Museum of Zoology, Dr. C. Bertrand Schultz, University of Nebraska State Museum, Dr. Otis Wade, University of Nebraska Department of Zoology, Miss Lucille Drury, Cleveland Museum of Natural History, Mr. W. E. Eigsti, Hastings Museum, Hastings, Nebraska, and to those in charge of the collections of the Nebraska Game, Forestation and Parks Commission.

ACCOUNTS OF SPECIES

Myotis evotis evotis (H. Allen)

Long-eared Myotis

Vespertilio evotis H. Allen, Smithsonian Misc. Coll., 165:48, June, 1864 (part), type from Monterey, Monterey Co., California.
Myotis evotis, Miller, N. Amer. Fauna, 13:78, October 16, 1897.

Distribution in Nebraska.—Pine Ridge area of northwestern part of state.

Record of occurrence.—Specimen examined, 1, as follows: SIOUX CO.: Warbonnet Canyon, 1 (Univ. Nebr. State Mus.).

Remarks.—This specimen was taken by Merritt Cary on July 22, 1901.

Myotis keenii septentrionalis (Trouessart)

Eastern Long-eared Myotis

[*Vespertilio gryphus*] var. *septentrionalis* Trouessart, Catal. Mamm. viv. foss., p. 131, 1897, type from Halifax, Halifax Co., Nova Scotia.
Myotis keenii septentrionalis, Miller and Allen, Bull. U. S. Nat. Mus., 144: 105, May 25, 1928.

Distribution in Nebraska.—Known from limestone quarries in Cass and Sarpy counties. Probably in other parts of extreme eastern Nebraska.

Records of occurrence.—Specimens examined, 35, as follows: CASS CO.: 1 mi. NE Louisville, 4. SARPY CO.: ½ mi. W Meadow, 31 (some of these specimens have been deposited in other collections as follows: Private Collection of P. H. Krutzsch, 3; Private Collection of W. G. Frum, 2; Nebr. Game, Forestation and Parks Comm., 1; Univ. Kansas Mus. Nat. Hist., 2; Univ. Nebr. State Mus., 7).

Remarks.—Although not so common as *Pipistrellus* in the limestone quarries, hibernating bats of this species frequently are found there, usually as solitary individuals either in drill holes or clinging to the walls of the quarries; occasionally, however, two or three bats have been found together in a single drill hole.

Myotis lucifugus carissima Thomas

Brown Myotis

Myotis (*Leuconoe*) *carissima* Thomas, Ann. and Mag. Nat. Hist., (ser. 7), 13:383, May, 1904, type from Yellowstone Lake, Yellowstone National Park, Wyoming.
Myotis lucifugus carissima, Cary, N. Amer. Fauna, 42:43, October 3, 1917.

Distribution in Nebraska.—Known from a single record in extreme northwestern Nebraska, but probably occurs throughout Panhandle of state.

Record of occurrence.—Specimen examined, 1, as follows: Sioux Co.: Agate, 1 (Univ. Mich. Mus. Zool.).

Myotis lucifugus lucifugus (Le Conte)

Brown Myotis

V[*espertilio*]. *lucifugus* Le Conte, McMurtrie's Cuvier, Animal Kingdom, 1:431, June, 1831, type from Georgia, probably from the Le Conte Plantation, near Riceboro, Liberty County.
Myotis lucifugus [*lucifugus*], Miller, N. Amer. Fauna, 13:59, October 16, 1897.

Distribution in Nebraska.—Known only from the limestone quarry in Sarpy County, but probably occurs over most of eastern third of state.

Records of occurrence.—Specimens examined, 2, as follows: Sarpy Co.: ½ mi. W Meadow, 2 (Univ. Kansas Mus. Nat. Hist., 1).

Remarks.—Two bats of this subspecies were found in the quarry in Sarpy County on December 30, 1949. None was found on subsequent visits to the quarry, although three other species of bats have been found there in large numbers. These specimens appear to be the first actual records of *M. l. lucifugus* in the state, although Swenk (1915:854, and in subsequent lists) reported it as "uncommon eastwardly".

One of these bats, a male (KU 35076), possesses a peculiar dental abnormality. Both of the second upper premolars (P3) are lacking, although the mandibular dentition is normal. This condition has been reported previously for this species by Frum (1946:176) in specimens from West Virginia.

Myotis subulatus subulatus (Say)

Small-footed Myotis

Vespertilio subulatus Say, Long's Exped. to Rocky Mts., 2:65 (footnote), 1823, type from the Arkansas River near La Junta, Otero Co., Colorado.
Myotis subulatus, Warren, The Mammals of Colorado, G. P. Putnam's Sons, New York, 1910. p. 275.

Distribution in Nebraska.—Northern and western Nebraska.

Records of occurrence.—Specimens examined, 9, as follows: Cherry Co.: Valentine, 1 (Univ. Nebr. Dept. Zool.). Sheridan Co.: Rushville, 1; 15 mi. N Rushville, 2. Sioux Co.: Agate, 1 (Univ. Kansas Mus. Nat. Hist.); Monroe Canyon, 5½ mi. N, 2½ mi. W Harrison, 2 (Nebr. Game, Forestation and Parks Comm.); Warbonnet Canyon, 2 (Univ. Nebr. State Mus.).

Additional records: Dakota Co.: Crystal Lake, 1 (Stephens, 1945: 92). Dawes Co.: Chadron, 1 (Miller and Allen, 1928:169). Sioux Co.: Antelope Township, 1 (Quay, 1948:181); Sugarloaf Township, 1 (Quay, 1948:181).

Remarks.—This bat is common along the Niobrara River in the northwestern part of the state. Stephens (*loc. cit.*) reports taking

a bat of this species in Dakota County in the northeastern corner of Nebraska. This specimen was sent to Swenk at the University of Nebraska for positive identification and was, according to Stephens, deposited in the Swenk collection. No trace of the specimen can be found at the present time. It is here assigned to *M. s. subulatus.*

M. s. subulatus has been observed frequently in the Pine Ridge area, generally in association with *Eptesicus fuscus pallidus.* Two specimens were shot by us from many that were seen flying over a small clearing in the pines in northern Sioux County on August 2, 1949. Several *Eptesicus* were also obtained there. One of us (Webb) took two of these bats from their daytime retreat in a barn north of Rushville, Sheridan County, on September 5, 1951, where *Eptesicus* was also found. They are known to inhabit hay barns at the Ft. Niobrara Game Reserve, Cherry County, also in association with *Eptesicus.* Swenk (1908:137) reports finding two of these bats under a loose strip of pine bark in Sioux County.

Myotis volans interior Miller

Hairy-winged Myotis

Myotis longricus interior Miller, Proc. Biol. Soc. Washington, 27:211, October 31, 1914, type from Twining, Taos Co., New Mexico.
Myotis volans interior, Miller and Allen, Bull. U. S. Nat. Mus., 144:142, May 25, 1928.

Distribution in Nebraska.—Badlands area of extreme northwestern part of state.

Records of occurrence.—Specimens examined, 2, as follows: Sioux Co.: Warbonnet Township, 8 mi. N Harrison, 2 (Cleveland Mus. Nat. Hist.).

Remarks.—Quay (1948:181) reported finding a colony of approximately 180 of these bats in northern Sioux County in the summer of 1944. They were found in a crevice in a dry creek bed. He examined several dozen, all females, two of which were saved as specimens.

The authors, while engaged in field work in this approximate locality in the summers of 1948 and 1949, were unable to locate any of these bats.

Lasionycteris noctivagans (Le Conte)

Silver-haired Bat

V[*espertilio*]. *noctivagans* Le Conte, McMurtrie's Cuvier, Animal Kingdom, 1:431, June, 1831, type from eastern United States.
Lasionycteris noctivagans, Peters, Monatsber. k. preuss. Akad. Wissensch. Berlin, p. 648, 1865.

Distribution in Nebraska.—"Entire state, fairly common during migrations but probably not breeding within our limits" (Swenk, 1908:138).

Records of occurrence.—Specimens examined, 2, as follows: Clay Co.: Inland, 1 (Hastings Museum, Hastings, Nebraska). Franklin Co.: Campbell, 1 (Hastings Museum, Hastings, Nebraska).

Additional records (Swenk, 1908:138): Cuming Co.: West Point. Douglas Co.: Omaha. Lancaster Co.: Lincoln. County undesignated: "Platte River".

Pipistrellus subflavus subflavus (F. Cuvier)

Eastern Pipistrelle

V[espertilio]. subflavus F. Cuvier, Nouv. Ann. Mus. Hist. Nat. Paris, 1:17, 1832, type from eastern United States, probably Georgia.
Pipistrellus subflavus, Miller, N. Amer. Fauna, 13:90, October 16, 1897.

Distribution in Nebraska.—Known from limestone quarries in Cass and Sarpy counties; probably ranging throughout eastern Nebraska.

Records of occurrence.—Specimens examined, 34, as follows: Cass Co.: 1 mi. NE Louisville, 4. Sarpy Co.: ½ mi. W Meadow, 30 (some of these specimens have been deposited in other collections as follows: Private Collection of P. H. Krutzsch, 3; Private Collection of W. G. Frum, 2; Univ. Kansas Mus. Nat. Hist., 4; Univ. Nebr. State Mus., 4).

Remarks.—This bat is the most common of the four species that are known to inhabit the quarries in Cass and Sarpy counties. Individuals have been found both in drill holes and clinging to the walls of the quarries. We have always found this bat to be solitary while in hibernation.

Eptesicus fuscus fuscus (Beauvois)

Big Brown Bat

Vespertilio fuscus Beauvois, Catal. Raisonné Mus. Peale, Philadelphia, p. 18, 1796, type from Philadelphia, Philadelphia Co., Pennsylvania.
Eptesicus fuscus, Méhely, Magyarország denevéreinek monographiája (Monographia Chiropterorum Hungariae), pp. 206, 338, 1900.

Distribution in Nebraska.—Eastern part of state.

Records of occurrence.—Specimens examined, 23, as follows: Adams Co.: Hastings, 1 (Hastings Museum, Hastings, Nebraska). Cass Co.: 1 mi. NE Louisville, 6; Plattsmouth, 1 (Univ. Nebr. State Mus.). Sarpy Co.: ½ mi. W Meadow, 15 (Univ. Nebr. State Mus., 7).

Remarks.—We have observed this bat hibernating in the limestone quarries of Cass and Sarpy counties, where it was commonly found in drill holes or clinging to the ceiling or walls. We have always found this bat to be solitary while in hibernation, with one exception. On January 31, 1949, a male and female were found in the same drill hole in the Cass County quarry. The jolt of being knocked from the hole separated the two bats, and upon examination the penis of the male was noted to be extended and erected, indicating that the pair might have been in the act of copulation.

Eptesicus fuscus pallidus Young

Big Brown Bat

Eptesicus pallidus Young, Proc. Acad. Nat. Sci. Philadelphia, p. 408, October 2, 1908, type from Boulder, Boulder Co., Colorado.
Eptesicus fuscus pallidus, Miller, Bull. U. S. Nat. Mus., 79:62, December 31, 1912.

Distribution in Nebraska.—Western half of state.

Records of occurrence.—Specimens examined, 34, as follows: CHERRY CO.: Ft. Niobrara Game Reserve, 19 (Nebr. Game, Forestation and Parks Comm., 17); Valentine, 2 (Univ. Nebr. Dept. Zool.). DAWES CO.: 10 mi. S Chadron, 1 (Univ. Mich. Mus. Zool.). KNOX CO.: Niobrara, 1. SHERIDAN CO.: 15 mi. N Rushville, 2. SIOUX CO.: Glen, 1 (Univ. Nebr. State Mus.); Monroe Canyon, 5½ mi. N, 2½ mi. W Harrison, 1 (Nebr. Game, Forestation and Parks Comm.); Warbonnet Canyon, 7 (Univ. Nebr. State Mus.).

Remarks.—A colony of approximately 100 of these bats was discovered in the unused portion of a barn loft at Ft. Niobrara Game Reserve on August 11, 1948. Although no temperature readings were taken, it was estimated that the temperature was more than 100° F. in the loft. The bats were congregated on rafters at the north end of the barn and when disturbed, only a few members of the colony dropped from the rafters to fly. Most of the bats crawled to new retreats between the rafters and the corrugated iron roof of the building.

Lasiurus borealis borealis (Müller)

Red Bat

Vespertilio borealis Müller, Natursyst. Suppl., p. 20, 1776, type from New York.
Lasiurus borealis [*borealis*], Miller, N. Amer. Fauna, 13:105, October 16, 1897.

Distribution in Nebraska.—State-wide in suitable habitat.

Records of occurrence.—Specimens examined, 14, as follows: LANCASTER CO.: Lincoln, 13 (Univ. Nebr. State Mus., 11; Univ. Nebr. Dept. Zool., 1). RICHARDSON CO.: 3 mi. SE Rulo, 1 (Nebr. Game, Forestation, and Parks Comm.).

Additional records (Swenk, 1908:139): CUMING CO.: West Point. DOUGLAS CO.: Omaha. LANCASTER CO.: Lincoln. OTOE CO.: Nebraska City. RICHARDSON CO.: Humboldt.

Lasiurus cinereus cinereus (Beauvois)

Hoary Bat

Vespertilio cinereus (misspelled *linereus*) Beauvois, Catal. Raisonné Mus. Peale, Philadelphia, p. 18, 1796, type from Philadelphia, Philadelphia Co., Pennsylvania.
Lasiurus cinereus, H. Allen, Smithsonian Misc. Coll., 17:21, June, 1864.

Distribution in Nebraska.—State-wide in suitable habitat.

Records of occurrence.—Specimens examined, 11, as follows: Clay Co.: Inland, 1 (Hastings Museum, Hastings, Nebraska). Custer Co.: Broken Bow, 2 (Univ. Mich. Mus. Zool.); Victoria Springs, 1 (Univ. Mich. Mus. Zool.). Furnas Co.: Wilsonville, 1 (Hastings Museum, Hastings, Nebraska). Lancaster Co.: Lincoln, 6 (Univ. Nebr. State Mus., 5; Univ. Nebr. Dept. Zool., 1).

Additional records: Cuming Co.: West Point (Swenk, 1908:139). Douglas Co.: Omaha (Swenk, 1908:139). Gage Co.: Beatrice (Swenk, 1908: 139). Lancaster Co.: Lincoln (Swenk, 1908:139). County undesignated: Loup Fork (Miller, 1897:114).

Tadarida mexicana (Saussure)

Mexican Free-tailed Bat

Molossus mexicanus Saussure, Revue et Magasin de Zoologie, Ser. 2, 12:283, July, 1860, type from Cofre de Perote, 13,000 feet, state of Veracruz, Mexico.
Tadarida mexicana, Miller, Bull. U. S. Nat. Mus., 128:86, April 29, 1924.

Distribution in Nebraska.—Known only from Lincoln, Lancaster County.

Records of occurrence.—Specimen examined, 1, as follows: Lancaster Co.: Lincoln, 1 (Univ. Nebr. State Mus.).

Additional record (Zimmer, 1913:665): Lancaster Co.: Lincoln.

Remarks.—The Mexican free-tailed bat is probably rare in Nebraska. The single specimen examined by us was obtained on June 27, 1931, from a downtown business building in Lincoln. According to the label on the specimen, it died in captivity on June 29 after giving birth to one young on June 28. The bat reported by Zimmer (*loc. cit.*) was also taken in the business district of Lincoln. It was obtained on August 15, 1913.

In addition to the bats named above, six other kinds possibly occur in Nebraska. These, along with an indication of the part of the state in which each is to be looked for, are as follows:

Myotis grisescens Howell, southeastern part of state.
Myotis sodalis Miller and Allen, southeastern part of state.
Myotis thysanodes thysanodes Miller, northwestern part of state.
Nycticeus humeralis humeralis (Rafinesque), southeastern part of state.
Corynorhinus rafinesquii pallescens (Miller), northwestern part of state.
Tadarida molossa (Pallas), any part of state.

LITERATURE CITED

ALLEN, H.
1864. Monograph of the bats of North America. Smithsonian Misc. Coll., 165:xxiii + 85, June, 1864.

FRUM, W. G.
1946. Abnormality in dentition of *Myotis lucifugus*. Jour. Mamm., 27:176, May 14, 1946.

MILLER, G. S., JR.
1897. Revision of the North American bats of the family Vespertilionidae. N. Amer. Fauna, 13:1-138, October 16, 1897.

MILLER, G. S., JR., and G. M. ALLEN
1928. The American bats of the genera *Myotis* and *Pizonyx*. Bull. U. S. Nat. Mus., 144:viii + 218, May 25, 1928.

QUAY, W. B.
1948. Notes on some bats from Nebraska and Wyoming. Jour. Mamm., 29:181-182, May 14, 1948.

SIMPSON, G. G.
1945. The principles of classification and a classification of mammals. Bull. Amer. Mus. Nat. Hist., 85:xvi + 350, October 5, 1945.

STEPHENS, T. C.
1945. Say's bat in Nebraska. Jour. Mamm., 26:92, February 27, 1945.

SWENK, M. H.
1908. A preliminary review of the mammals of Nebraska. Proc. Nebr. Acad. Sci., 8:61-144, 1908.
1915. The birds and mammals of Nebraska. Nebr. Blue Book and Historical Register, pp. 851-855, 1915.
1918. The birds and mammals of Nebraska. Nebr. Blue Book and Historical Register, pp. 407-411, December, 1918.
1919. The birds and mammals of Nebraska. Univ. Nebr. Contrib. Dept. Ent., 23:1-21, March 1, 1919.
1920. The birds and mammals of Nebraska. Nebr. Blue Book and Historical Register, pp. 479-483, December, 1920.

TAYLOR, W. P.
1919. Notes on mammals collected principally in Washington and California between the years 1853 and 1874 by Dr. James Graham Cooper. Proc. Calif. Acad. Sci., 9:69-121, July 12, 1919.

ZIMMER, J. T.
1913. A northwardly record of the free-tailed bat. Science (NS), 38:665-666, November 7, 1913.

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24-2965

Geographic Variation in Red-backed Mice (Genus Clethrionomys) of the Southern Rocky Mountain Region

BY

E. LENDELL COCKRUM and KENNETH L. FITCH

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Geographic Variation in Red-backed Mice (Genus Clethrionomys) of the Southern Rocky Mountain Region

BY

E. LENDELL COCKRUM and KENNETH L. FITCH

In the course of the preparation of a synopsis of the North American terrestrial microtines by one of us (Cockrum), and the completion of a Master's thesis on the geographical variation of the red-backed mice of Wyoming by the other (Fitch) we had occasion to study the red-backed mice of the southern Rocky Mountain region (see figure 1). Results of these studies are the recognition of two heretofore unnamed subspecies of the red-backed mouse in the southern Rocky Mountain region, and a clarification of the taxonomic status of two additional kinds.

Clethrionomys gapperi galei (Merriam)

1890. *Evotomys galei* Merriam, N. Amer. Fauna, 4:23, October 8.
1931. *Clethrionomys gapperi galei,* Hall, Univ. California Publ. Zool., 37:6, April 10.
1897. *Evotomys gapperi galei,* Bailey, Proc. Biol. Soc. Washington, 11: 126, May 13.

Type locality.—Ward, 9500 feet, Boulder County, Colorado.

Range.—The Rocky Mountains of extreme southern Alberta, Montana, northwestern and southern Wyoming, and north and central Colorado.

Remarks.—C. g. galei, with the largest geographic range of any of the Rocky Mountain subspecies, is also the most variable. Three principal areas of geographic variation were found. These areas are: The mountains of north-central Colorado and southern Wyoming (this area includes the type locality); the Big Horn area probably northwest into Montana (no adult specimens from Montana or Alberta examined); and the Teton area which includes the mountains east and southeast of Yellowstone National Park. Specimens from these areas have noticeable differences in pelage, but no constant cranial differentiation could be detected. Specimens from the Medicine Bow Mountains of southern Wyoming have a more reddish dorsal stripe, and more buff and less gray on the sides than either of the northern geographic variants. The dorsal stripe continues farther anteriorly and is better defined through its entire length. There are fewer differences between the two north-

ern geographic variants than between either one of them and the southern variant. Specimens from the Teton Mountains, however, have grayer sides, and the outer margin of the ear is tipped with chestnut (little or no chestnut shows on the ears of the specimens from the Big Horn Mountains); the dorsal stripe is less distinct (with slightly more gray throughout) than in either of the other geographic variants of the one subspecies.

Three specimens (two adults) are available from the Little Medicine Range in Converse County (22 miles south and 24.5 miles west of Douglas, 7600 feet), Wyoming. Although red-backed mice probably are found in the mountains of Natrona and Albany counties, the population in the Little Medicine Range is somewhat isolated. In coloration these mice are lighter than any of the three geographic variants described above; the dorsal stripe is narrower; the sides are more buffy; the dorsal stripe does not project anteriorly beyond the ears as it does in the specimens from the Medicine Bow Mountains; and the face is grayer. These specimens resemble the population in the Big Horn Mountains to the north more than the population in the Medicine Bow Mountains.

The specimens from the Little Medicine Range, the Big Horn Range, and the Tetons are possibly subspecifically distinct from the southern specimens. Examination of specimens now allocated to *galei* from Montana and Alberta should aid in revealing whether the northern animals are an unnamed subspecies.

Specimens examined.—Total, 167, distributed as follows and unless otherwise stated, in the collection of the University of Kansas Museum of Natural History:

Wyoming: *Park County:* 28 mi. N and 3 mi. W Cody, 7200 ft., 1. *Big Horn County:* Medicine Wheel Ranch, 28 mi. E Lovell, 9000 ft., 22; 17½ mi. E and 4½ mi. S Shell, 1. *Teton County:* Moran, 6244 ft., 4; Moran, 3 (James Findley Collection); 2¾ mi. E Moran, 6300 ft., 1; 3¾ mi. E and 1 mi. S Moran, 6200 ft., 10. *Washakie County:* 9 mi. E and 9 mi. N Tensleep, 8200 ft., 3; 9 mi. E and 4 mi. N Tensleep, 7000 ft., 1. *Johnson County:* 4 mi. W and 1 mi. S Klondike, 6500 ft., 1; 6½ mi. W and 2 mi. S Buffalo, 5620 ft., 1. *Lincoln County:* 3 mi. N and 11 mi. E Alpine, 5650 ft., 1. *Sublette County:* 31 mi. N Pinedale, 8025 ft., 1. *Fremont County:* Togwotee Pass, 5 (James Findley Collection); 20½ mi. W and 2 mi. S Lander, 1; Mocassin [= Moccasin] Lake, 19 mi. W and 4 mi. N Lander, 10,100 ft., 3; 18 mi. W and 3 mi. N Lander, 1; Mosquito Park Ranger Station, 17½ mi. W and 2½ mi. N Lander, 9500 ft., 10; 6½ mi. W and 17 mi. S Lander, 8450 ft., 4; 5½ mi. W and 22 mi. S Lander, 8800 ft., 3. *Converse County:* 22 mi. S and 24½ mi. W Douglas, 7600 ft., 3. *Carbon County:* 18 mi. SW Rawlins, 7500 ft., 2; 19 mi. E and 8 mi. N Encampment, 9150 ft., 4; 19½ mi. E and 8 mi. N Savery, 8800 ft., 1; 11 mi. E and 6 mi. N Savery, 8400 ft., 1; 14 mi. E and 6 mi. N Savery, 1. *Albany County:* 3 mi. ESE Browns Peak, 10,000 ft., 59.

Colorado: *Rio Blanco County:* 9½ mi. SW Pagoda Peak, 7700 ft., 2. *Boulder County:* 2½ mi. S Estes Park, 8400 ft., 2; 3 mi. S Ward, 8. *Clear*

Creek County: 2 mi. S Idaho Springs, 8000 ft., 1. *Gunnison County:* Gothic, 8 mi. N Crested Butte, 6 (James Findley Collection).

Additional records.—**Colorado:** *Rio Blanco Co.:* 25 mi. NE Meeker (Cary, N. Amer. Fauna, 33:120, 1911). *El Paso Co.:* Lake Moraine, 10,250 ft. (Warren, Mammals of Colorado, p. 224, 1942).

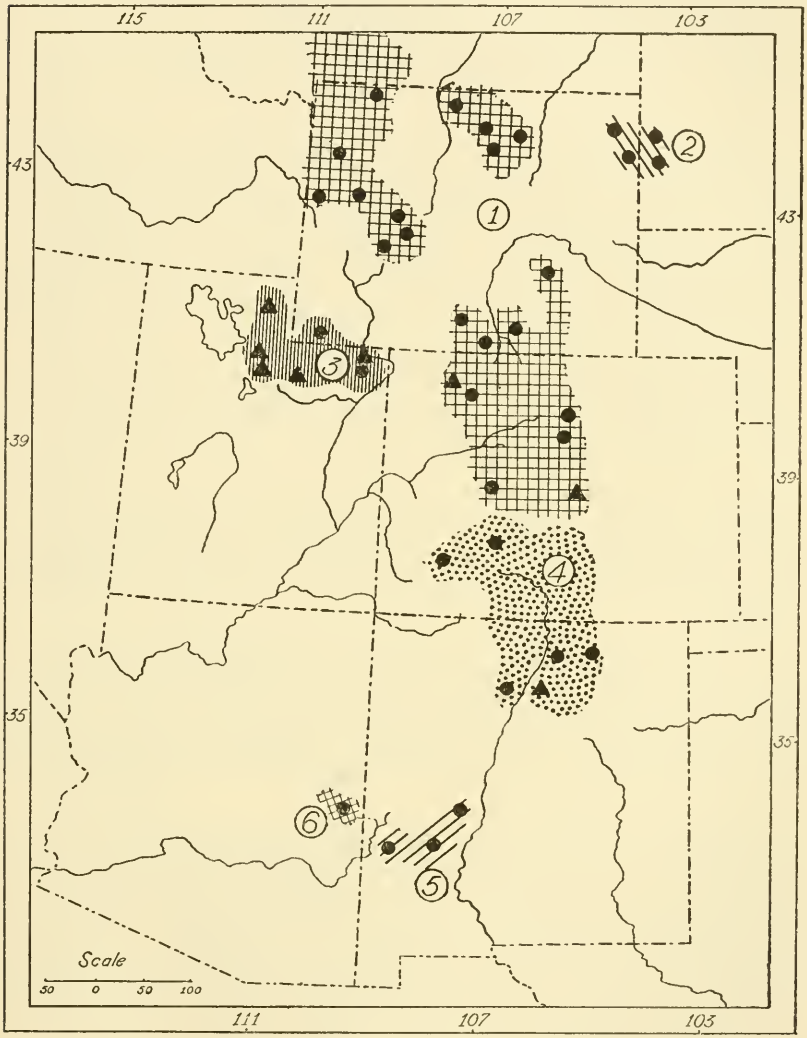

FIG. 1.—Geographic ranges of the subspecies of *Clethrionomys gapperi* in the southern Rocky Mountains.

1. *C. g. galei*
2. *C. g. brevicaudus*
3. *C. g. uintaensis*
4. *C. g. gauti*
5. *C. g. limitis*
6. *C. g. arizonensis*

Clethrionomys gapperi brevicaudus (Merriam)

1891. *Evotomys gapperi brevicaudus* Merriam, N. Amer. Fauna, 5:119, July 30.
1897. *Evotomys brevicaudus,* Bailey, Proc. Biol. Soc. Washington, 11:129, May 13.
1942. *Clethrionomys gapperi brevicaudus,* Bole and Moulthrop, Sci. Publ. Cleveland Mus. Nat. Hist., 5:153, September 11.

Type locality.—Three miles N Custer, 6000 ft., South Dakota.

Range.—The Black Hills of South Dakota and Wyoming.

Remarks.—Merriam (N. Amer. Fauna, 5:119, July 30, 1891) named this subspecies on the basis of two specimens collected in the Black Hills of South Dakota in July, 1888, and assigned it to the species *Evotomys* [= *Clethrionomys*] *gapperi.* He reported the diagnostic characteristics as: "Similar to *E. gapperi,* but with larger ears and shorter tail. The hazel of the dorsal area is not so bright as in *gapperi;* the sides are the same golden brown." Of the cranial and dental characteristics he wrote: "Much as in *E. gapperi.*"

Bailey (Proc. Biol. Soc. Washington, 11:129, May 13, 1897), in his "Revision of the American voles of the genus *Evotomys,*" with one additional specimen available, raised the Black Hills population to specific status, re-emphasizing the shortness of the tail, and pointing out a few slight cranial differences ("zygomatic arches low and flaring out, so that the inner instead of the outer side shows in top view; auditory bullae as large as in *gapperi,* but less rounded").

Bailey (*loc. cit.*) remarked that: "though based on so scanty material, the characters distinguishing the species are fairly pronounced. Its range is isolated and widely separated from that of any other members of the genus by open prairie country and a wide belt of the Transition zone. There seems to be no valid reason for considering it a subspecies."

Additional specimens have been taken in recent years from the Black Hills of South Dakota and northeastern Wyoming. This material has shed light on the relationships and morphological characteristics of the red-backed mice of this region. Bole and Moulthrop (Sci. Publ. Cleveland Mus. Nat. Hist., 5:153, September 11, 1942) listed, as comparative material, eight specimens from Bull Springs, Custer County, South Dakota, under the name *Clethrionomys gapperi brevicaudus* (Merriam). They gave no reason for arranging *brevicaudus* as a subspecies of *C. gapperi.*

Twenty adults (11 skins and skulls, 9 skulls only) from Pennington County, South Dakota (specimens in the University of Michi-

gan Museum of Zoology), have the following measurements (averages of external measurements based on 11 specimens only): Total length, 142 (123-155); tail, 35 (30-39); hind foot, 19.5 (18.6-21.0); basal length, 23.3 (21.7-24.5); condylobasilar length, 23.3 (21.9-24.5); zygomatic breadth, 13.7 (12.9-14.7); lambdoidal breadth, 11.7 (11.3-12.9); alveolar length upper cheek-teeth, 5.5 (5.2-5.8); interorbital breadth, 3.9 (3.6-4.1); length of nasals, 7.7 (7.1-8.5); breadth of rostrum, 3.2 (2.9-3.6); and length of incisive foramina, 5.0 (4.6-5.3).

Measurements of the type and one "more fully adult topotype" (as given by Bailey, *op. cit.*) are: Total length, 125, 130; tail length, 31, 32; hind foot, 19, 19; basal length, 21.2, 21.8; length of nasals, 6.6, 7.0; zygomatic breadth, 12.5, 12.8; mastoid breadth, 11.3, 11.0; alveolar length of upper molar series, 5.4, 5.3. In every measurement the figures for Bailey's specimens are smaller than the average of the same measurement in the 20 adults from Pennington County, and, in most measurements, are even lower than the minimum of the latter series. Therefore, we conclude that the material available to Merriam (*op. cit.*) and Bailey (*op. cit.*) consisted of only subadults.

In comparison with a series of 23 adult *Clethrionomys gapperi galei* from 28 mi. E Lovell, Big Horn County, Wyoming, *C. g. brevicaudus* has a slightly shorter tail, longer hind foot, greater basal and condylobasilar lengths, greater zygomatic and lambdoidal breadths and conspicuously longer nasals.

In comparison with three adult *C. g. loringi* from Elk River, Sherburne County, Minnesota, *C. g. brevicaudus* has a greater total length, longer hind foot, greater basal length, conspicuously greater zygomatic and lambdoidal breadths, much longer nasals, and a narrower rostrum.

Clethrionomys gapperi brevicaudus, although isolated geographically and although morphologically more distinct than many of the currently recognized subspecies of *C. gapperi,* is probably best arranged as a subspecies of *C. gapperi* rather than as a full species. In certain characters, such as interorbital breadth and breadth of rostrum, it is intermediate between *C. g. galei* and *C. g. loringi,* but it resembles *C. g. galei* more than it does any other named kind.

Specimens examined.—Total, 66. Unless otherwise indicated, specimens from Wyoming are in the University of Kansas Museum of Natural History and specimens from South Dakota are in the University of Michigan Museum of Zoology. Specimens are distributed as follows:

Wyoming: *Crook County:* 3 mi. NW Sundance, 5900 ft., 3. *Weston County:* 1½ mi. E Buckhorn, 6150 ft., 21; 12 mi. SE Newcastle, 1 (Univ. Michigan).

South Dakota: *Pennington County:* ½ mi. E Rochford, 1; 17 mi. NW Custer, 1; 16 mi. NW Custer, 20; 16 mi. SW Rapid City, 1; 3 mi. SE Hill City, 2; 4 mi. SE Hill City, 13; 5 mi. SE Hill City, Harney Peak, 7240 ft., 1. *Custer County:* 1½ mi. E Sylvan Lake, 1.

Clethrionomys gapperi uintaensis Doutt

1897. *Evotomys gapperi galei,* Bailey, Proc. Biol. Soc. Washington, 11:127 (part from Uinta Mts. of Wyoming), May 13.
1941. *Clethrionomys gapperi uintaensis* Doutt, Proc. Biol. Soc. Washington, 54:161, Dec. 8.

Type locality.—Paradise Park, 10,050 feet, 45 miles by road northwest Vernal, Uintah County, Utah.

Range.—The Uinta Mountains of northern Utah and southwestern Wyoming.

Remarks.—From the description given by Doutt (Proc. Biol. Soc. Washington, 54:161, 1941) in his original description of this subspecies, it appears that he had available for comparisons, only subadult specimens of *C. g. galei.* As judged from the material of *C. g. uintaensis* available to us (1 topotype, KU 38081, and 7 specimens from Uinta County, Wyoming, listed below) and from Doutt's (*op. cit.*) description and measurements, the subspecies *C. g. uintaensis* is but weakly differentiated from *C. g. galei.* No marked cranial differences are evident between the two subspecies; the differences in pelage noted by Doutt (*op. cit.*:161), however ("Similar to *Clethrionomys gapperi galei* from Ward, Colorado, but head and cheeks grayer; sides and back paler; belly whiter."), do seem to be valid.

On the basis of these differences in pelage and the geographic isolation of the range, we judge that *uintaensis* should be retained as a subspecies of *C. gapperi.* It is clear, however, that *C. g. uintaensis* is less distinct from *C. g. galei* than are the other adjacent subspecies.

Specimens examined.—Total, 8, all in the University of Kansas Museum of Natural History, distributed as follows:

Wyoming: *Uinta County:* 9 mi. S Robertson, 8000-8400 ft., 3; 9 mi. S and 2 mi. E Robertson, 8000 ft., 2; 11½ mi. S and 2 mi. E Robertson, 9200 ft., 1; 14 mi. S and 2 mi. E Robertson, 9000 ft., 1.

Utah: *Uintah County:* Paradise Park, 21 mi. W, 15 mi. N Vernal, 10,050 ft., 1.

Additional, marginal records (Durrant, Univ. Kansas Publ., Mus. Nat. Hist., 6:356, August 19, 1952).—Utah: *Rich Co.:* Monte Cristo, 18 mi. W Woodruff, 8000 ft. *Salt Lake Co.:* Emigration Canyon, 8 mi. above forks, 6,000 ft.; Silver Lake Post Office (Brighton), 9,500 ft. *Wasatch Co.:* Wolf Creek Summit, 9,800 ft. *Daggett Co.:* Beaver Dams, 10,500 ft.

Clethrionomys gapperi gauti, new subspecies

Type.—Male, adult, skin and skull; No. 133515, Biological Surveys Collections, United States National Museum, from Twining, 10,700 ft., Taos County, New Mexico; obtained on August 7, 1904, by James H. Gaut, original number 3086.

Range.—The Rocky Mountains of north-central New Mexico and south-central Colorado.

Diagnosis.—A brightly colored *Clethrionomys gapperi;* dorsal stripe near Chestnut (capitalized color terms after Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912) with an underwash of near Light Ochraceous-Buff and a mixture of black-tipped guard hairs giving an over-all effect of between Tawny and Russet; braincase relatively large; zygomatic width and lambdoidal width large; nasals long.

Comparisons.—As compared with topotypes of *C. g. galei,* the color is lighter, the dorsal reddish stripe slightly narrower, sides brighter, with a wash of Light Ochraceous-Buff, grading ventrally into a slight wash of Pale Ochraceous-Buff, instead of a silvery-white venter characteristic of *C. g. galei;* zygomatic and lambdoidal breadths are greater, nasals slightly shorter, auditory bullae slightly more inflated, teeth larger, and braincase larger.

As compared with topotypes of *C. g. limitis, C. g. gauti* is darker, has a greater zygomatic breadth, longer upper tooth-row, longer nasals, and narrower rostrum.

Measurements.—External and cranial measurements of the type, and the average and extreme measurements of four adult males and one adult female from the type locality (including the type) and five miles south of the type locality are: Total length, 144, 147 (140-152); tail, 40, 42 (39-45); hind foot, 20, 19.3 (19-20); condylobasilar length, 22.3, 22.9 (22.2-24.0); zygomatic breadth, 13.6, 13.7 (13.5-14.0); lambdoidal breadth, 11.9, 11.7 (11.4-12.0); alveolar length of upper cheek-teeth, 5.1, 5.2 (5.1-5.4); interorbital breadth, 4.0, 3.9 (3.8-4.0); length of nasals, 7.0, 7.2 (7.0-7.6); breadth of rostrum, 2.9, 3.1 (2.9-3.4); length of incisive foramina, 4.8, 5.1 (4.8-5.3).

Remarks.—Two specimens from a locality 21 mi. W and 3 mi. N Saguache, Saguache County, Colorado, although referred to this subspecies on the basis of paler pelage, inflation of auditory bullae, and heavier teeth, show characters of *C. g. galei* in the narrowness across the zygomata and lambdoidal crest. Four specimens from Silverton (1 adult and 3 young adults) are referable to this subspecies on the basis of color of pelage and cranial proportions but are smaller than either *C. g. gauti* or *C. g. galei.*

The specimen from Pecos Baldy, Pecos Mountain, San Miguel County, New Mexico, referred by Bailey (N. Amer. Fauna, 52:192) to *Clethrionomys gapperi galei,* is here referred to *C. g. gauti* on geographical grounds.

The name *gauti* is proposed in honor of the collector of the type specimen, James H. Gaut.

Specimens examined.—Total, 14, distributed as follows and, unless otherwise stated, in the Biological Surveys Collection:

Colorado: *Saguache County:* 21 mi. W and 3 mi. N Saguache, N 38°, 106° 31′, 9100 ft., 2 (Univ. Kansas Mus. Nat. Hist.). *San Juan Co.:* Silverton, 4.

New Mexico: *Taos County:* Twining, 10,700 ft., 3; 5 mi. S Twining, 11,400 ft., 3. *Sandoval County:* Goat Peak, Jemez Mountains, 1. *Colfax County:* 15 mi. SW Cimarron, 9000 ft., 1 (Amer. Mus. Nat. Hist.).

Additional records.—New Mexico: *San Miguel Co.:* Pecos Baldy, Pecos Mountain, 1 (Bailey, N. Amer. Fauna, 52:192, 1932).

Clethrionomys gapperi limitis (Bailey)

1913. *Evotomys limitis* Bailey, Proc. Biol. Soc. Washington, 26:133, May 21.

Type locality.—Willow Creek, a branch of the Gilita, 8500 ft., Mogollon Mountains, Catron County, New Mexico.

Range.—Known from the Mogollon, San Mateo, and Magdalena mountains of western New Mexico.

Remarks.—Bailey (Proc. Biol. Soc. Washington, 26:133, May 21, 1913) described this animal as a species and gave as general characteristics: "Size slightly larger than *E.* [= *Clethrionomys gapperi*] *galei;* colors duller, grayer and less buffy; skull and dentition heavier." He further characterized the skull as: "Larger, heavier and conspicuously more ridged than in *galei;* bullae large and especially deep; dentition heavy throughout." The type of *C. limitis,* as judged from the measurements given by Bailey (*loc. cit.*), is an exceptionally old male.

Our comparison of six adult topotypes with a series of *C. g. galei* from Wyoming (18 adults from 3 mi. SSE Browns Peak, 10,000 ft., Albany County, in Univ. Kansas Mus. Nat. Hist.) and with three near-topotypes of *C. g. galei* (3 mi. S Ward, 9000 ft., Boulder County, Colorado, in Univ. Kansas Mus. Nat. Hist.) revealed that most of the differences noted by Bailey (*loc. cit.*) are not evident when individuals of comparable ages are examined. Some specimens of *C. g. galei* exceed *C. limitis* in ridging of the skull and size of the teeth although conspicuous ridges and large teeth are supposedly distinctive of *C. limitis.* The bullae, although averaging larger in *C. limitis,* can be matched in size by those of specimens of *C. g. galei* from Wyoming.

The differences evident between *C. limitis* and *C. g. galei* are of the kind and degree that serve to separate subspecies in the species *Clethrionomys gapperi* and, although actual evidence of intergradation is lacking, we think that the relationships of *limitis* are better expressed by arranging it as a subspecies of *C. gapperi* than by retaining it as a full species.

Specimens examined.—Total, 7, all in the Biological Surveys Collection, distributed as follows:

New Mexico: *Catron County:* Willow Creek, 8500 ft., Mogollon Mountains, 4. *Socorro County:* San Mateo Peak, 10,000 ft., San Mateo Mountains, 2; Copper Canyon, 9000 ft., Magdalena Mountains, 1.

Clethrionomys gapperi arizonensis, new subspecies

Type.—Female, adult, skin and skull; No. 158401, Biological Surveys Collection, United States National Museum; from Little Colorado River, 8300 ft., White Mountains, Apache County, Arizona; obtained September 12, 1908, by C. Birdseye, original number 152.

Range.—Known only from the White Mountains of eastern Arizona.

Diagnosis.—Dorsal stripe near Chestnut, with an underwash of between Tawny and Russet, and a mixture of black-tipped hairs, resulting in an overall effect of near Chestnut. Skull wide across zygomatic arches and narrow across mastoids; rostrum narrow and posterior border of palate straight.

Comparisons.—This subspecies needs close comparison only with the adjacent subspecies *C. g. limitis.* As compared with topotypes of *limitis, C. g. arizonensis* has darker pelage, narrower rostrum, greater width across zygomatic arches, lesser lambdoidal breadth, longer nasals, wider palate, and more inflated auditory bullae. The posterior border of the hard palate is straight in five skulls of the series that are complete (two skulls have the palatal regions broken); all *C. g. limitis* examined have a median posterior projection on the posterior border of the hard palate.

Measurements.—External and cranial measurements of the type, and the average and extreme measurements of three adult males and two adult females from the type locality (including the type) are: Total length, 160, 145.6 (137-160); tail, 44, 40.8 (37-46); hind foot, 18.5, 19.3 (18-20); condylobasilar length, 23.3, 22.8 (22.1-23.5); zygomatic breadth, 13.8, 13.4 (12.6-13.8); lambdoidal breadth, 11.5, 11.4 (11.0-11.6); alveolar length upper cheek-teeth, 5.5, 5.4 (5.2-5.5); interorbital breadth, 3.8, 3.9 (3.8-4.0); length of nasals, 7.6, 7.1 (6.9-7.6); breadth of rostrum, 3.1, 3.1 (3.0-3.2); length of incisive foramina, 5.5, 5.2 (5.0-5.5).

Remarks.—Hall and Davis (Proc. Biol. Soc. Washington, 47:55, February 9, 1934) reported 12 specimens of red-backed mice from Hannagan Meadow, 9500 to 9600 ft., and ten from Hannagan Creek, 8600 ft., all in Greenlee County, Arizona. Although they pointed out most of the cranial differences here described as diagnostic of *C. g. arizonensis,* they did not name the animals as new since they had no seasonally comparable materials; thus they were unable to evaluate the differences noted in pelage. We have not examined the material referred to by Hall and Davis (*loc. cit.*), but, on the basis of their description, here refer it to *C. g. arizonensis.*

Specimens examined.—Total, 7, all from the type locality and all in the Biological Surveys Collection in the United States National Museum.

Grateful acknowledgment is made of the opportunity to study the specimens from New Mexico and Arizona in the Biological Surveys Collection of the United States National Museum and the material from South Dakota in the University of Michigan Museum of Zoology, as well as for the financial support afforded one of us (Cockrum) by the University of Kansas from its Research appropriation. Cockrum's work was part of a larger investigation of the geographic distribution of all North American native mammals, aided by a contract between the Office of Naval Research, Department of the Navy, and the University of Kansas (NR. 161-791). Also, assistance with some of field work was given by the Kansas University Endowment Association.

Transmitted June 21, 1952.

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Comments on the Taxonomy and Geographic Distribution of North American Microtines

BY

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IN preparing maps showing the geographic distribution of North American microtines, conflicting statements in the literature and identifications that, if accepted, would result in improbable geographic ranges have led to the examination of pertinent specimens with the results given below. The studies here reported upon were aided by a contract between the Office of Naval Research, Department of the Navy, and the University of Kansas (Nr 161-791), by funds provided by the University of Kansas from its Research Appropriation, and by grants for out-of-state field work from the Kansas University Endowment Association. Grateful acknowledgment is made to persons in charge of the collections at each of the following institutions for permission to use the collections under their charge: Biological Surveys Collection, United States National Museum (herein abbreviated USBS); California Museum of Vertebrate Zoology (MVZ); Chicago Natural History Museum (CNHM); University of Kansas Museum of Natural History (KU); Museum of Comparative Zoology (MCZ); United States National Museum (USNM); Department of Economic Zoology, University of Wisconsin (UWDEZ); and Zoological Museum, University of Wisconsin (UWZM).

Synaptomys cooperi saturatus Bole and Moulthrop

1942. *Synaptomys cooperi saturatus* Bole and Moulthrop, Sci. Publs. Cleveland Mus. Nat. Hist., 5:149, September 11, type from Bloomington, McLean County, Illinois.

When Bole and Moulthrop named *Synaptomys cooperi saturatus*, with type locality in Illinois, they, in effect, divided the geographic range of *Synaptomys cooperi stonei* into two parts (see A. B. Howell, N. Amer. Fauna, 50:10 (fig. 2), August 5, 1927) since Bole and Moulthrop (*op. cit.*) did not assign to any subspecies the specimens from southern Wisconsin that Howell (*op. cit.*) had identified as *S. c. stonei*. Bole and Moulthrop's inclusion in their newly named

subspecies of a specimen from as far west as East Columbia, Missouri, left in doubt the subspecific identity of specimens from Iowa and a specimen from Arkansas. Howell (*op. cit.*) had assigned this material from Iowa and Arkansas to *S. c. gossii.*

Howell recognized that the one individual (168266 USBS) from Lake City, Arkansas, was too young to be identified to subspecies with certainty and assigned the specimen to *S. c. gossii* "upon geographical grounds" (*op. cit.* :19). Keith R. Kelson and one of us (Hall) compared this specimen with pertinent materials. As a result of this comparison we refer the specimen, on the same grounds employed by Howell, to *Synaptomys cooperi saturatus.*

Specimens from approximately the southern half of Wisconsin (from Kelly Lake southward) were referred to *S. c. stonei* by Howell (*op. cit.* :16). Now that *S. c. saturatus* has been recognized, these specimens from southern Wisconsin would be expected to be referable to *S. c. saturatus.* When these specimens were examined and compared (by Hall and Kelson) with other specimens in the United States National Museum the skulls were found to be much larger than in *S. c. cooperi,* smaller than in *S. c. gossii,* and nearly the size of those of *Synaptomys cooperi saturatus,* to which subspecies we refer the specimens in question.

Howell (*op. cit.* :16) referred a specimen from Cassopolis, Michigan, a locality that might be presumed to fall within the range of the more recently named *S. c. saturatus,* to *S. c. stonei.* Bole and Moulthrop did not mention this specimen when they described and named *S. c. saturatus* (1942). Neither did Burt, but Cassopolis is within the geographic range ascribed to *S. c. cooperi* on his map (The Mammals of Michigan, Univ. Michigan Press, p. 213, 1946). Examination (by Kelson and Hall) of the specimen (41777 MCZ) reveals that it resembles *S. c. cooperi* in shortness of hind foot (18 mm.), shortness of tail (18 mm.), narrowness across zygomata (16 mm.), and grayish pelage. In the long braincase, heavy rostrum, greater condylobasilar length, greater lambdoidal breadth, long rostrum, and longer incisive foramina, it agrees closely with specimens of *S. c. saturatus,* to which subspecies we refer the specimen.

Necker and Hatfield (Bull. Chicago Acad. Sci., 6:54, 1941) referred specimens from Rosiclaire, Illinois, to *S. c. gossii.* These specimens were not mentioned by Bole and Moulthrop (*op. cit.*) when they named *S. c. saturatus* although the specimens presumably would be referred to the newly-named subspecies. We have ex-

amined the pertinent specimens (Nos. 15781-15786 and 16049-16054 CNHM) and find that on the basis of dark color, long and slender skull, heavy incisors, and small cheek-teeth, they are referable to *S. c. saturatus* Bole and Moulthrop. None, however, has a tail so short as the type of *S. c. saturatus*. For that matter, the average length of the tail of six near topotypes (5 mi. W, 2½ mi. S Monticello, Piatt County, Illinois, Nos. 32037-32042 KU) exceeds that of the type (17.4 mm., range 12-20, as compared to 14 mm. for the type).

Synaptomys cooperi gossii (Coues)

1877. *Arvicola (Synaptomys) gossii* Coues, Monogr. N. Amer. Rodentia, p. 235 (published as a synonym of *Synaptomys cooperi*, but name stated to apply to Kansan specimens of which description and measurements are on p. 236), type from Neosho Falls, Woodson County, Kansas.
1897. *Synaptomys cooperi gossii*, Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 49:307, June.

In view of the taxonomic treatment accorded by Bole and Moulthrop (Sci. Publs. Cleveland Mus. Nat. Hist., 5:149-151, September 11, 1942) to the lemming mice of the species *Synaptomys cooperi*, as explained in the preceding account, it has seemed desirable to examine Iowan specimens of this species. Hall and Kelson examined the necessary material and made the following conclusions. An adult male from Hillsboro (168453 USBS) has the lighter color and large skull of *S. c. gossii* to which Howell (N. Amer. Fauna, 50:19, August 5, 1927) referred the specimen. The more western specimen from Knoxville, a young male (190358 USNM), is almost exactly the same age as a male of *S. c. saturatus* from Bascom, Indiana (143701 USNM), and is but slightly older than a male *S. c. gossii* from Ft. Leavenworth, Kansas (91583 USBS). The upper molariform tooth-row is the same length in the specimens from Kansas and Iowa, but is longer in that from Indiana. The fact that the specimen from Knoxville closely resembles the Kansan specimen in other dimensions of the skull, which is larger than in the specimen from Indiana, gives a basis for applying the name *Synaptomys cooperi gossii* to the specimen from Knoxville. This is the same name recently used by Fichter and Hansen (Bull. Univ. Nebraska State Mus., 3(2):2, September, 1947) for the Iowan specimens, although they seemingly applied the name without being aware of Bole and Moulthrop's earlier naming of *S. c. saturatus* (Sci. Publs. Cleveland Mus. Nat. Hist., 5:149, September 11, 1942).

Synaptomys borealis sphagnicola Preble

1899. *Synaptomys (Mictomys) sphagnicola* Preble, Proc. Biol. Soc. Washington, 13:43, May 29, type from Fabyans, Coos County, New Hampshire.
1927. *Synaptomys borealis sphagnicola,* A. B. Howell, N. Amer. Fauna, 50:30, August 5.

Howell (N. Amer. Fauna, 50:30-31, August 5, 1927) had only eight specimens of this subspecies available when he revised the genus *Synaptomys.* Of these eight (Maine: Mount Katahdin, 2; New Brunswick: Near Bathurst, 1; New Hampshire: Fabyans, 1, the type; Quebec: St. Rose, 4), only the type and one of the specimens from St. Rose are adults. Concerning the others, Howell wrote (*op. cit.* :31): "The example from near Bathurst is not adult and has a damaged skull, so is identified provisionally. All other specimens are too young for positive diagnosis."

Since Howell's revision only one additional specimen has been reported. Anderson (Ann. Rept. Provancher Soc. for 1939, p. 71, 1940) reported it from Table Mountain, 3888 ft., Gaspé County, Quebec.

In the collection of the University of Kansas Museum of Natural History there is still another specimen. It is an adult male topotype (No. 6483 KU, formerly No. 72 in the collection of Alfred E. Preble) obtained on August 21, 1905, at Fabyans, New Hampshire. The measurements of this specimen are as follows (measurements in parenthesis are those of the type as given by Howell, *op. cit.*): Total length, 135 (132); tail, 26 (24); hind foot, 22 (20); condylobasilar length, 25.1 (25.8); rostral length, 6.5 (6.8); rostral breadth, 4.7 (4.9); interorbital breadth, 3.3 (2.8); zygomatic breadth, 15.4 (16.0); lambdoidal breadth, 12.1 (12.4); incisive foramina, 5.9 (5.7); height of skull, 9.1 (9.3).

Howell (*op. cit.*:30) characterized *S. b. sphagnicola* as: "Large and high [skull] with narrow interorbital sharply ridged, the ridges of the type being joined for a distance of 4 millimeters; interparietal narrow and rectangular. The rostrum is long, tapering very little, and the nasals, slightly constricted medially are quite narrow posteriorly. The incisive foramina are long and wide." Howell further stated (*op. cit.*:30-31) that: "It is hard to predict what will be found to constitute the most valuable cranial characters in distinguishing this race from adult *medioximus.* The discernible differences now are in the shape of the interparietals, rostral characters, and interorbital differences that will probably not hold good when animals of the same age are compared."

As can be seen from a comparison of the measurements given

above for the type and the topotype, some of the characteristics given by Howell are not found in the topotype: The interorbital region is not narrow (in fact it is wider than it ordinarily is in some other subspecies of *Synaptomys borealis*) and the incisive foramina are not longer than in other subspecies of *Synaptomys borealis.*

As far as present material permits us to judge, *Synaptomys borealis sphagnicola* is characterized, cranially, by: Skull large; interorbital region sharply ridged (the ridges being joined for a distance of 4 mm. in the type and of 4.5 mm. in the topotype); rostrum long, tapering relatively little; nasals slightly constricted medially and unusually narrow posteriorly; interparietal narrow and rectangular.

Clethrionomys occidentalis caurinus (Bailey)

1898. *Evotomys caurinus* Bailey, Proc. Biol. Soc. Washington, 12:21, January 27, type from Lund, east shore Malaspina Inlet, British Columbia.
1935. *Clethrionomys gapperi caurinus,* Racey and Cowan, Rept. British Columbia Prov. Mus. for 1935, p. H 25.

Prior to 1935 *caurinus* was considered to be a monotypic species. In 1935 Racey and Cowan (Rept. British Columbia Provincial Museum for 1935, pp. H 25-H 26) examined material from southwestern British Columbia of *C. caurinus,* including a series of 24 specimens from Alta Lake, and compared it with *Clethrionomys gapperi occidentalis* and *C. g. saturatus.* They found *caurinus* to be distinct from *C. g. saturatus* but were "not convinced that *occidentalis* and *caurinus* both merit systematic recognition; should they prove to be indistinguishable, as the little available material indicates, *occidentalis* will take precedence on grounds of priority. It is our opinion that further study of the distribution of the genus in British Columbia will lead to the recognition of *occidentalis* as the form inhabiting coast-line and *saturatus* the interior of British Columbia" p. H 26. In the face of these opinions Racey and Cowan nevertheless recognized *caurinus* under the name *Clethrionomys gapperi caurinus* (Bailey).

In spite of the treatment by Racey and Cowan (*op. cit.*) of *occidentalis* and *caurinus* as subspecies of *C. gapperi,* later authors arranged *occidentalis* as a member of the *"californicus"* group although they retained *caurinus* in the *gapperi* group. For example, Davis (The Recent Mammals of Idaho, The Caxton Printers, pp. 307-308, 1939) assigned *C. caurinus* to the *gapperi* group, although he regarded *C. caurinus* as a species (not a subspecies). He regarded also *C. occidentalis* as a species (not a subspecies) but assigned it to the *californicus* group. Dalquest (Univ. Kansas Publ.,

Mus. Nat. Hist., 2:344, April 9, 1948) considered *occidentalis* to be conspecific with *Clethrionomys californicus* and wrote (*op. cit.* :101): "The *californicus* group, I feel, contains only the races of *Clethrionomys californicus,* while the *gapperi* group contains *C. gapperi* and its races, including *caurinus,* and possible other species." Dalquest gave no indication that he had examined any specimens of *caurinus.*

When Dalquest (*op. cit.*:344) arranged *occidentalis* and *californicus* as subspecies of the same species, he used the name combination *Clethrionomys californicus occidentalis* because he ignored, or was unaware of, the page priority of *occidentalis* over *californicus.* We regard the anterior position of *occidentalis* as nomenclatural priority and therefore employ *occidentalis* rather than *californicus* as the specific name.

Differences between the *gapperi* group and the *occidentalis* group include: postpalatal bridge (complete in both groups) truncate posteriorly in the *gapperi* group and with a median, posteriorly directed, spine in the *occidentalis* group (this character is not evident in all specimens; some *gapperi* have a spine, and some *occidentalis* have the spine much reduced); dentition of the *occidentalis* group is heavier; enamel pattern of M3 and m1 in *occidentalis* more simplified—the number of salient and re-entrant angles tends to be reduced in adults of the *occidentalis* group.

An examination of specimens of *caurinus* (British Columbia: Mt. Seymour, 2 KU; Lund, Malaspina Inlet, 2 USBS; and Inverness, mouth Skeena River, 1 USBS), reveals that, in the presence of the median postpalatal spine and in the characters of the molars, *caurinus* agrees with the *occidentalis* group.

Clethrionomys occidentalis nivarius (Bailey)

1897. *Evotomys nivarius* Bailey, Proc. Biol. Soc. Washington, 11:136, May 13, type from northwest slope of Mount Ellinor, 4000 ft., Olympic Mts., Mason County, Washington.

The red-backed mouse of the Olympic Peninsula was originally accorded specific rank. Currently it stands in the literature as a subspecies of the wide-spread species *Clethrionomys gapperi* because Dalquest (Univ. Kansas Publ. Mus. Nat. Hist., 2:343, April 9, 1948) used the name-combination *Clethrionomys gapperi nivarius.* Taylor and Shaw had earlier (Occas. Papers Charles R. Conner Mus., 2:23, 1929) indicated the same status by using the name *Evotomys gapperi nivarius.* Davis (The Recent Mammals of Idaho, The Caxton Printers, Caldwell, Idaho, p. 306, April 5, 1939), however, indicated that the affinities of *nivarius* were with the *califor-*

nicus [= *occidentalis*] group, although he treated *nivarius* as a distinct species. We have examined two adult females (K. U. Nos. 10707 and 10708) of *nivarius* from Reflection Lake, 3800 ft., Jefferson County, Washington, and on the basis of their thick, instead of thin, pterygoid processes concur with Davis that the affinities of *nivarius* are with the named kinds of *Clethrionomys* now arranged as subspecies of *Clethrionomys occidentalis,* rather than with the kinds now arranged as subspecies of *Clethrionomys gapperi.* Although we are aware that Dalquest (*op. cit.*:101-102) did not find actual intergradation between *nivarius* and *Clethrionomys occidentalis occidentalis*—a ten-mile gap separated their ranges—we prefer to use the name combination *Clethrionomys occidentalis nivarius.* In doing so we recognize that intergradation ultimately may be found between the two species *C. occidentalis* and *C. gapperi;* in that event the name *gapperi* will apply as the name of the species because it has priority over *occidentalis.*

The following named kinds of *Clethrionomys* are considered to be subspecies of *Clethrionomys occidentalis:*

CLETHRIONOMYS OCCIDENTALS OCCIDENTALIS (Merriam).

1890. *Evotomys occidentalis* Merriam, N. Amer. Fauna, 4:25, October 8, type from Aberdeen, Chehalis County, Washington.
1894. *Evotomys pygmaeus* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, p. 284, October 23, type from mouth of Nisqually River, Pierce County, Washington.
1929. *Evotomys gapperi occidentalis,* Taylor and Shaw, Occas. Papers Charles R. Conner Mus., Washington State College, 2:23.
1948. *Clethrionomys californicus occidentalis,* Dalquest, Univ. Kansas Publ., Mus. Nat. Hist., 2:344, April 9.

CLETHRIONOMYS OCCIDENTALIS CALIFORNICUS (Merriam).

1890. *Evotomys californicus* Merriam, N. Amer. Fauna, 4:26, October 8, type from Eureka, Humboldt County, California.

CLETHRIONOMYS OCCIDENTALIS CAURINUS (Bailey).

1898. *Evotomys caurinus* Bailey, Proc. Biol. Soc. Washington, 12:21, January 27, type from Lund, east shore of Malaspina Inlet, British Columbia.
1935. *Clethrionomys gapperi caurinus,* Racey and Cowan, Rept. British Columbia Prov. Mus. for 1935, p. H 25.

CLETHRIONOMYS OCCIDENTALIS MAZAMA (Merriam).

1897. *Evotomys mazama* Merriam, Proc. Biol. Soc. Washington, 11:71, April 21, type from Crater Lake, 7000 ft., Mount Mazama, Klamath County, Oregon.
1936. *Clethrionomys californicus mazama,* Bailey, N. Amer. Fauna, 55:192, August 29.

CLETHRIONOMYS OCCIDENTALIS NIVARIUS (Bailey).

1897. *Evotomys nivarius* Bailey, Proc. Biol. Soc. Washington, 11:136, May 13, type from northwest slope of Mount Ellinor, 4000 ft., Olympic Mts., Mason County, Washington.

Clethrionomys occidentalis obscurus (Merriam).

1897. *Evotomys obscurus* Merriam, Proc. Biol. Soc. Washington, 11:72, April 21, type from Prospect, 2600 ft., upper Rogue River Valley, Jackson County, Oregon.
1933. *Clethrionomys mazama obscurus,* Grinnell, Univ. California Publ. Zool., 40:185, September 26.
1936. *Clethrionomys californicus obscurus,* Bailey, N. Amer. Fauna, 55:192, August 29.

Clethrionomys gapperi pallescens, new name

1940. *Clethrionomys gapperi rufescens* R. W. Smith, Amer. Midland Nat., 24:233, July, type from Wolfville, Kings County, Nova Scotia (*nec Arvicola rufescens* de Selys Longchamps, 1836, from Longchamps-sur-Ger, Belgium).

The name *rufescens,* as applied by R. W. Smith (Amer. Midland Nat., 24:233, July, 1940) to the red-backed mouse of Nova Scotia, seems to be unavailable under the rules of the International Code of Zoological Nomenclature, since it is a homonym of *Arvicola rufescens* de Selys Longchamps, 1836, which in turn is a synonym of *Clethrionomys glareolus glareolus* Schreber, 1780 (Ellerman and Morrison-Scott, Checklist of Palaearctic and Indian Mammals, 1758 to 1946, p. 663, November 19, 1951).

Clethrionomys gapperi phaeus (Swarth)

1911. *Evotomys phaeus* Swarth, Univ. California Publ. Zool., 7:127, January 12, type from Marten Arm, Boca de Quadra, Alaska.

When Swarth (*loc. cit.*) named the red-backed mouse of the mainland of southern Alaska as a new subspecies, he characterized it as "Size rather large. Differs from *E.* [= *Clethrionomys*] *wrangeli,* nearest it geographically, in cranial characters and in much longer tail; from *E. caurinus,* the species to the southward in British Columbia, in larger size and longer tail." He remarked (*loc. cit.*): "I had supposed that the red-backed mouse occurring on the mainland coast of this region would prove to be *E. wrangeli,* but the latter appears to be purely an insular species. I have had no specimens of that race for comparison, but the *Evotomys* secured differ so widely from it in all the essential peculiarities of the species as given in the published descriptions that there seems little doubt of their belonging to a different species. *Wrangeli* has a short tail, less than twice as long as the hind foot—in adults of *phaeus* the tail is invariably more than twice the length of the foot, frequently more than a third of the entire length of the animal."

The external and cranial measurements of two subadults in the United States National Museum (No. 217413 from Quadra Lake and No. 217415 from Marten Arm, Boca de Quadra, taken in mid-February) and three old adults from Fort [= Port] Simpson, Brit-

ish Columbia (Nos. 90263-90264, 90272 USBS), are almost the same as those given by Swarth in the original description of *Clethrionomys phaeus.*

In cranial measurements, as well as in the structure of the palate and last upper molar, *C. phaeus* agrees with the *gapperi* group (to which it has been assigned by Davis, The Recent Mammals of Idaho, The Caxton Printers, p. 306, April 5, 1939, and by Orr, Jour. Mamm., 26:69, February 12, 1945) and differs from *Clethrionomys occidentalis caurinus* (which was assigned above to the *occidentalis* group, formerly the *californicus* group).

Since the measurements of specimens examined by us, as well as those recorded by Swarth (*op. cit.*), fall within the range of those of the species *Clethrionomys gapperi,* and since the differences between *phaeus* and *C. g. saturatus* are of the kind and degree that separate subspecies in *C. gapperi* we employ the name combination *Clethrionomys gapperi phaeus* (Swarth). *C. g. saturatus,* as understood by us, occurs to the southeast of *C. g. phaeus* in the Rocky Mountains of British Columbia, and in northeastern Washington, northern Idaho and northwestern Montana.

Specimens examined.—Total, 23, distributed as follows: **Alaska:** Chickamin River (Behm Canal), 15 (MVZ); Boca de Quadra, 3 (MVZ); Marten Arm, Boca de Quadra, 1 (USNM); Quadra Lake, 1 (USNM). **British Columbia:** Fort [= Port] Simpson, 3 (USBS).

Clethrionomys gapperi wrangeli (Bailey)

1897. *Evotomys wrangeli* Bailey, Proc. Biol. Soc. Washington, 11:120, May 13, type from Wrangell, Wrangell Island, Alaska.

When Bailey (*loc. cit.*) named the red-backed mouse from Wrangell Island, Alaska, he characterized it as "A large, dull-colored species entirely distinct from any known form," and remarked: "In no way does *E.* [= *Clethrionomys*] *wrangeli* show a close relationship to any other American species. In size and relative proportions it comes closest to *E. dawsoni,* from which it differs widely in coloration and more widely in cranial characters. With the long-tailed species south and east of its range there is no need of comparison."

Swarth (Univ. California Publ. Zool., 24:173, June 17, 1922) reported that three specimens from Flood Glacier and 23 from Great Glacier, British Columbia, and four from Sergief Island, at the mouth of the Stikine River, Alaska, were: "All *E. wrangeli,* indistinguishable from specimens at hand from Wrangell Island." Swarth further reported that, although he found no intergradation between *Clethrionomys wrangeli* from Flood Glacier and the nearly adjacent

Clethrionomys rutilus dawsoni, "the two species, however, resemble each other so closely in form, and in some pelages in color also, that *wrangeli* would seem to be a coastal offshoot of *dawsoni*. . . ."

Davis (The Recent Mammals of Idaho, The Caxton Printers, p. 306, April 5, 1939) and Orr (Jour. Mamm., 26:69, February 12, 1945) more recently have shown that *Clethrionomys wrangeli* is not a member of the *rutilus* group (to which *C. dawsoni* belongs) but is a member of the *gapperi* group.

Our comparisons of a series of eight topotypes of *wrangeli* (all in the Biological Surveys Collection) with several subspecies of *Clethrionomys gapperi* (including *phaeus, saturatus, galei, brevicaudus,* and others) reveal that the differences seen in *wrangeli* are of the kind and degree that serve to separate subspecies. The red-backed mouse from Wrangell Island, then, should stand as *Clethrionomys gapperi wrangeli* (Bailey).

Specimens examined.—Total, 31, distributed as follows: **Alaska:** Wrangell, Wrangell Island, 27 (19 MVZ., 8 USBS); Sergief Island at mouth of Stikine River, 4 (MVZ).

Clethrionomys gapperi solus, new subspecies

Type.—Male, adult, skin and skull, No. 74939, Biological Surveys Collection, United States National Museum; from Loring, Revillagigedo Island, Alaska; obtained on September 22, 1895, by C. P. Streator; original No. 4980.

Range.—Known only from two localities on Revillagigedo Island, Alaska.

Diagnosis.—A short-tailed, dark-colored member of the *gapperi* group. Dorsal stripe wide, between Chestnut and Bay (capitalized color terms after Ridgway: Color Standards and Color Nomenclature. Washington, D. C., 1912), with slight mixture of black-tipped hairs; sides and venter heavily washed with Ochraceous-Tawny. Skull flattened; rostrum proportionately short and wide; auditory bullae relatively uninflated.

Comparisons.—From topotypes of *Clethrionomys gapperi wrangeli, C. g. solus* differs as follows: dorsal stripe wider and slightly brighter; sides brighter; venter more heavily washed with Ochraceous-Tawny (heavy wash in all 13 *C. g. solus* examined; in *C. g. wrangeli* no wash in 11, slight wash in 16, and heavy wash in only one); nasals, alveolar extent of upper cheek-teeth and incisive foramina shorter; skull shallower when measured with tympanic bullae included; rostrum averages slightly broader.

From *C. g. phaeus* of the adjacent mainland, *C. g. solus* differs in: dorsal stripe slightly darker; ventral wash more prominent; tail shorter; skull smaller in all parts measured except that nasals are

approximately the same length, auditory bullae notably smaller and teeth notably narrower.

Measurements.—External and cranial measurements of adults are shown in table 1.

Remarks.—Bailey (Proc. Biol. Soc. Washington, 11:120, May 13, 1897) referred 17 specimens from Loring to his newly named species, *E. wrangeli* [= *Clethrionomys gapperi wrangeli*] but based his description on specimens from Wrangell Island. He pointed out (*loc. cit.*) that all of the specimens from Loring had the "bellies strongly washed with buffy-ochraceous, while more than half of those from Wrangell have whitish bellies."

Specimens examined.—Total, 13, all in the Biological Surveys Collection, U. S. National Museum, from the following localities: Alaska: Revillagigedo Island: Loring, 10; mouth of Fish Creek, Ketchikan, 3.

Clethrionomys gapperi stikinensis, new subspecies

Type.—Male, adult, skin and skull, No. 30735, Museum of Vertebrate Zoology, University of California; from Stikine River at Great Glacier, British Columbia; obtained on August 13, 1919, by J. Dixon; original number 7691.

Range.—Known only from the lower Stikine River Valley of British Columbia and the Cleveland Peninsula of Alaska.

Diagnosis.—A medium-sized, dark-colored member of the *gapperi* group. Dorsal stripe wide, near Auburn with mixture of black-tipped hairs; sides and venter washed with Ochraceous-Tawny. Skull small; cheek-teeth narrow; auditory bullae relatively uninflated.

Comparisons.—From topotypes of *Clethrionomys gapperi wrangeli, C. g. stikinensis* differs as follows: dorsal stripe slightly wider and brighter; sides slightly duller (lacking the olivaceous wash of *C. g. wrangeli*); all cranial measurements taken averaging smaller except height of skull, which is approximately the same; alveolar length of upper tooth-row and length of incisive foramina notably shorter; auditory bullae less inflated; cheek-teeth much narrower.

From topotypes of *C. g. phaeus, C. g. stikinensis* differs as follows: dorsal stripe and sides darker; auditory bullae less inflated; cheek-teeth narrower; skull smaller in most measurements taken (see table 1).

From topotypes of *C. g. solus, C. g. stikinensis* differs as follows: dorsal stripe lighter (more tawny underwash); ventral wash of buffy much paler (especially noticeable around mouth and on throat); zygomatic and lambdoidal breadths greater; skull deeper; auditory bullae more inflated; cheek-teeth slightly heavier.

TABLE 1. *External and cranial measurements of Clethrionomys.*

Number of individuals averaged of each sex or specimen measured	Total length	Tail	Hind foot	Condylobasilar length	Zygomatic breadth	Lambdoidal breadth	Length of nasals	Alveolar length of upper tooth-row	Breadth of rostrum	Length of incisive foramina	Height of skull
Clethrionomys gapperi solus, Loring											
♂ type	133	33	20	22.3	12.5	10.9	6.8	5.1	3.4	5.3	9.0
♂ 5 av.	131	34	20	22	12.7	10.8	6.8	5.3	3.5	5.1	9.1
min.	128	33	19	21.8	12.5	10.5	6.7	5.1	3.3	5.0	8.9
max.	133	36	20	22.3	13.0	11.2	7.1	5.5	3.6	5.3	9.5
♀ 5 av.	128	34	19	21.3	12.5	10.5	6.5	5.4	3.5	4.9	9.2
min.	124	31	19	20.9	12.3	10.3	6.0	5.2	3.3	4.8	8.9
max.	140	36	20	21.7	12.7	10.7	7.0	5.6	3.6	5.0	9.5
Clethrionomys gapperi stikinensis, Stikine River at Great Glacier											
♂ type	145	39	20	23.2	13.9	11.4	7.3	5.0	3.1	5.5	9.5
♂ 4 av.	136	35	20	22.2	13.0	11.1	6.8	5.2	3.4	5.2	9.4
min.	132	33	19	21.5	12.3	10.7	6.5	5.0	3.1	5.1	9.1
max.	145	39	20	23.2	13.9	11.4	7.3	5.6	3.5	5.5	9.7
♀ 7 av.	134	33	19	21.8	12.7[6]*	10.9	7.0	5.4	3.4	5.1	9.5
min.	125	30	19	21.5	12.5	10.5	6.7	5.3	3.2	5.0	9.2
max.	147	35	20	22.2	12.9	11.3	7.1	5.6	3.7	5.3	9.8
Clethrionomys gapperi wrangeli, Wrangell											
♂ 9 av.	139	36	19	23.4[8]	13.3	11.4[8]	7.3	5.6	3.6	5.6	9.6[8]
min.	130	31	18	22.9	13.0	10.9	7.1	5.5	3.3	5.4	9.2
max.	151	43	20	23.9	13.7	11.8	7.6	5.8	4.0	5.8	10.1
♀ 16 av.	134	34	18[15]	23.2	13.3	11.2[13]	7.3	5.8	3.5	5.5	9.4
min.	123	28	17	22.4	12.6	10.7	6.9	5.5	3.2	5.2	9.0
max.	156	45	20	24.1	14.1	11.8	8.0	6.1	3.7	5.9	9.7
Clethrionomys gapperi phaeus, Chickamin River											
♂ 5 av.	148	47	20	23.0[4]	13.7[4]	11.3[4]	7.5[4]	5.3[4]	3.5[4]	5.3[4]	9.7[3]
min.	138	38	20	22.3	13.0	11.1	7.1	5.3	3.4	4.9	9.3
max.	159	51	21	23.8	14.6	11.8	7.7	5.6	3.8	5.6	10.0
♀ 4 av.	153	49	20	23.1[3]	13.4	11.2[3]	7.6[3]	5.2	3.7	5.3	9.6[3]
min.	140	44	20	22.4	12.8	10.8	7.3	5.0	3.4	5.1	9.2
max.	164	56	20	24.2	13.6	11.4	7.7	5.3	3.9	5.5	9.8

* Superior numbers denote the number of individuals averaged.

Measurements.—External and cranial measurements of adults are given in table 1.

Remarks.—Morphologically *C. g. stikinensis* shows greater resemblance to *C. g. solus* of Revillagigedo Island, than to the geographically adjacent subspecies *C. g. wrangeli* and *C. g. phaeus.* Possibly the original stock of *C. g. solus* was rafted to Revillagigedo Island from the Cleveland Peninsula.

Specimens examined.—Total, 29, all in the Museum of Vertebrate Zoology, University of California, distributed as follows: British Columbia: Stikine River at Great Glacier, 22; Stikine River at Flood Glacier, 3. Alaska: Bradfield Canal, 1; Helm Bay, 2.

Pitymys pinetorum scalopsoides (Audubon and Bachman)

1841. *Arvicola scalopsoides* Audubon and Bachman, Proc. Acad. Nat. Sci. Philadelphia, 1:97, type from Long Island, New York.
1912. *Pitymys pinetorum scalopsoides* Miller, U. S. Nat. Mus. Bull., 79:229, December 31.

Hanson (Trans. Wisconsin Acad. Sci., Arts, and Letters, 36:124, 1944) reported two pine mice from near Prairie du Sac, in Westpoint Township, Columbia County, Wisconsin, as *Pitymys pinetorum scalopsoides* but cast doubt upon their subspecific identity. He also reported pine mice from Blue Mounds, Dane County, Wisconsin. We have examined these specimens (Westpoint, Columbia County, 2—No. 544, skin only, UWDEZ, and No. 521, skin only, H. C. Hanson's private collection; Westpoint, Dane County, 1, No. 11620, UWZM; Vermont, Dane County, 2, Nos. 11674 and 11694, UWZM) and have compared them with topotypes of *P. p. schmidti,* and with specimens of *P. p. nemoralis* and *P. p. scalopsoides.* The specimens from Columbia and Dane counties differ from *P. p. schmidti* in the greater zygomatic breadth, and lesser height of skull. They differ from *P. p. nemoralis* of comparable age in shorter tooth-row and generally smaller skull. The interorbital region, however, is wider. In all of the features mentioned above, the specimens in question agree with *Pitymys pinetorum scalopsoides,* to which subspecies they are here referred.

Microtus pennsylvanicus aztecus (Allen)

1893. *Arvicola (Mynomes) aztecus* Allen, Bull. Amer. Mus. Nat. Hist., 5:73, April 28, type from Aztec, 5900 ft., San Juan County, New Mexico.

Allen (*loc. cit.*) described this species on the basis of two specimens from Aztec, New Mexico, and three from La Plata, New Mexico. He characterized it as "Size large; pelage very full and soft; tail short; skull very narrow.

"Above grayish brown with a tinge of pale buff; fur blackish plumbeous beneath the surface, tipped with pale yellowish brown,

and varied with longer, projecting, black-tipped hairs; below grayish white, the fur plumbeous beneath the surface and tipped with white, giving a whitish gray effect. Feet dusky; tail dusky brown above, dull white below."

Allen identified as this species "a large *Arvicola* from Estes Park, Colorado, which I have before been unable to allocate. I am unable to find that it differs in any particular from the specimens from New Mexico." He pointed out also (*op. cit.* :73-74) that "The type and only positively identified specimen of Baird's *Arvicola modesta* [= *Microtus pennsylvanicus modestus* (Baird)] from Sawatche Pass, Colorado, is a very young specimen in poor condition. An examination of a series of adult and young examples from the type locality will be necessary in order to determine its relationships to *A. alticolus* [= *Microtus longicaudus alticolus* (Merriam)] and *A. aztecus.*"

Bailey, in his revision of the American voles of the genus *Microtus* (N. Amer. Fauna, 17:20), showed *Arvicola modesta* Baird to be a subspecies of *Microtus pennsylvanicus* but retained *Microtus aztecus* (Allen) as a distinct species. In describing *M. aztecus* he wrote "the size similar to *M. pennsylvanicus,* but with shorter tail and larger hindfoot; skull long; braincase narrow; interparietal long . . ." and remarked that "*Microtus aztecus* belongs to the *pennsylvanicus* group. Externally it is not very different from *modestus*, but none of the specimens show any signs of intergradation; and the skull characters are so well marked that there seems no doubt of its full specific rank."

Subsequent to the publication of Allen's (*op. cit.*) account and Bailey's account (*op. cit.*), additional material was collected that helps to clarify the relationships of *Microtus aztecus.* A comparison of six adult topotypes of *Microtus aztecus* with a series of nine adults of *M. p. modestus* from 1 mi. S, 2 mi. E Eagle Nest, 8100 ft., Colfax County, New Mexico, with three adults from 1½ mi. E Manassa, Conejos County, Colorado, and with four adults from Saguache County, Colorado (all in KU), reveals that the supposed "well marked" external and cranial differences between the two forms are not nearly so evident as was indicated by Bailey.

The cranial differences that exist between these two forms (narrower nasals, slightly longer interparietal, slightly longer and narrower skull in *aztecus*) are evident only as averages. Although geographically intermediate specimens are lacking, the morphological differences between the two kinds of animals are of the de-

gree and kind that separate subspecies, rather than species. We therefore judge *M. aztecus* (Allen) to be only subspecifically distinct from *M. pennsylvanicus modestus* and employ the name *Microtus pennsylvanicus aztecus.*

Microtus pennsylvanicus funebris Dale

1940. *Microtus pennsylvanicus funebris* Dale, Jour. Mamm., 21:338, August 14, type from Coldstream, 1450 ft., 3½ mi. SE Vernon, British Columbia.

Taylor and Shaw (Occas. Papers Charles R. Conner Mus., State College Washington, 2:24, December, 1929) list under *Microtus nanus* [= *montanus*] *canescens* material from Calispell Peak, Washington. Probably the basis for this record is a specimen in the Biological Surveys collection (adult male, 236474) taken on May 9, 1921, by G. G. Cantwell, and labelled as Calispell Peak, 9 mi. W Locke, 3500 ft., Pend Oreille County. An examination (by Hall and Kelson) of the specimen discloses that it is of the species *Microtus pennsylvanicus,* and that it falls within the geographic range ascribed to the subspecies *Microtus pennsylvanicus funebris* by Dalquest (Univ. Kansas Publ., Mus. Nat. Hist., 2:346, April 9, 1948).

Microtus oeconomus amakensis Murie

1930. *Microtus amakensis* Murie, Jour. Mamm., 11:74, February 11, type from Amak Island, Bering Sea, Alaska.

When Murie (Jour. Mamm., 11:75, February 11, 1930) named the meadow mouse from Amak Island, Alaska, as *amakensis,* he arranged it as a separate species. One of us (Hall) and K. R. Kelson examined the type and topotypes of *amakensis* in the Biological Surveys collection in the U. S. National Museum and compared them with series of *Microtus oeconomus operarius, M. o. sitkensis, M. o. elymocetes, M. o. yakutatensis,* and *M. o. kadiacensis.* Among the specimens examined of the latter subspecies were 17 from Izambek Bay, Kadiak Peninsula, on the mainland opposite Amak Island, the type locality of *amakensis.* The characters given by Murie (*op. cit.*) serve to separate *amakensis* from closely related neighboring kinds of meadow mice, but are of the degree and kind that, in this group of meadow mice, separate subspecies rather than species. Although actual intergrades are lacking, the animals from Amak Island are considered to be only subspecifically distinct and to belong to the *oeconomus* complex. The name *Microtus oeconomus amakensis* is applied to them.

Microtus longicaudus mordax (Merriam)

1891. *Arvicola (Mynomes) mordax* Merriam, N. Amer. Fauna, 5:61, July 30, type from Sawtooth (= Alturas) Lake, 7200 ft., east base of Sawtooth Mountains, Blaine County, Idaho.
1938. *Microtus longicaudus mordax,* Goldman, Jour. Mamm., 19:491, November 14.

Dalquest (Univ. Kansas Publ., Mus. Nat. Hist., 2:353, April 9, 1948) assigned all the meadow mice of the species *Microtus longicaudus* from approximately the eastern half of Washington State to *Microtus longicaudus halli* Hayman and Holt and, in doing so, excluded the subspecies *Microtus longicaudus mordax* from that state. This assignment of specimens in Washington had the effect of separating the geographic range of *M. l. mordax* into two parts. One part was in south-central British Columbia and the other part was mainly in the Rocky Mountain region of the United States. Hall and Kelson examined specimens in the Biological Surveys collection in the U. S. National Museum in an attempt to determine more precisely the ranges of the subspecies in southern Canada, Washington, and Idaho.

Microtus longicaudus angustus [= *M. l. halli*] was described by one of us (Hall, Univ. California Publ. Zool., 37:13, April 10, 1931) as differing from *mordax* in narrower braincase, higher skull near the anterior end of the frontals, darker coloration, and seemingly smaller size. After examining the material in the U. S. National Museum no reason is seen at the present time to amend this characterization, except to add that some specimens of *M. l. mordax* are as dark as seasonably comparable specimens of *M. l. halli.*

Examination of specimens of *Microtus longicaudus* from Washington east of the Cascade Range (those from the Blue Mountain area excepted) discloses that the skulls do not differ essentially from those of topotypes of *M. l. mordax,* but do differ, as outlined above, from near-topotypes of *M. l. halli.* There is considerable variation in color among the Washington-taken specimens of *Microtus longicaudus.* Animals from the eastern flanks of the Cascades average darker than those taken, north of the Snake River, still farther east in Washington. Possibly Dalquest (*op. cit.*) relied mainly upon this darker color in assigning the specimens from eastern Washington to *M. l. halli.* Relying principally upon cranial characters, we conclude that most of the specimens are better referred to *M. l. mordax* and that *M. l. halli* is restricted, in Washington, to the Blue Mountains.

Specimens examined of *Microtus longicaudus mordax.*—Total, 74, all in the Biological Surveys Collection, distributed as follows: Washington: *Okanogan*

County: mouth of Holmar Creek, W Fork Paysaten River, 4700 ft., 1; Conconully, 3; Twisp, 1; Omak Lake, 1200 ft., 3. *Stevens County:* 5 mi. N Colville, 1. *Pend Oreille County:* 9 mi. N Metalina, 2600 ft., 1; Sullivan Lake, 3000 ft., 3. *Chelan County:* Sethekin, 1079 ft., 3; head of Lake Chelan, 900 ft., 12; Hart Lake, Railroad Creek, 3900 ft., 1; Entiat, 20 mi. from mouth of Entiat River, 1680 ft., 13; Wenatchee, 4. *Douglas County:* Waterville, 1. *Jefferson County:* Cleveland, 2. *Kittitas County:* 2 mi. S Blewett Pass, 3000 ft., 6; Ellensburg, 1500 ft., 4. *Whitman County:* Colfax, 2. *Yakima County:* McAllister Meadows, Tieton River, 3000 ft., 3; Gotchen Cr., 5500 ft., near Sava Spring, Mt. Adams, 2. *Klickitat County:* 8 mi. S Glenwood, base Mt. Adams, 2. *Asotin County:* Anatone, 3300 ft., 4; Bly, 1000 ft., 2.

Microtus miurus muriei Nelson

1931. *Microtus muriei* Nelson, Jour. Mamm., 12:311, August 24, type from Kutuk River (tributary of Alatna River), Endicott Mts., Alaska.

Rausch (Jour. Washington Acad. Sci., 40:135, April 21, 1950) proposed the name *Microtus miurus paneaki,* with type locality at Tolugak Lake, lat. 68° 24′ N, long. 152° 10′ W), Brooks Range, Alaska, for a meadow mouse of the subgenus *Stenocranius.* This place is only approximately forty miles east and north of the type locality of the earlier named *Microtus muriei,* also a member of the subgenus *Stenocranius.* Large series of specimens of this subgenus, from the Arctic Slope of Alaska, are in the Museum of Natural History of the University of Kansas. Study of these indicates that the differences, which Rausch (*op. cit.*:136) described as distinguishing his *M. m. paneaki* from *M. muriei,* result from differences in age of the specimens, and possibly in part from differences in seasonal condition of pelage. For example, Rausch thought that *M. m. paneaki* was larger than *M. muriei* but our specimens reveal that such is not the case. The measurements given below of the type specimen of *M. muriei* (after Nelson, original description) and measurements (in parentheses) of an immature female (43807 K. U.) of *Microtus miurus muriei* from Chandler Lake, 68° 12′, 152° 45′, 2900 ft., Alaska, show close correspondence in size. Total length, 119 (122); tail vertebrae, 24 (24); hind foot, 20 (20); condylobasal length, 24.3 (24.5); zygomatic breadth, 10.7 (11.0); greatest width of braincase, 9.0 (9.0); length of nasals, 6.5 (6.0); basal width of rostrum, 4.0 (4.3). In the light of all of the evidence now available, it seems best to treat *Microtus miurus paneaki* Rausch as a synonym of *Microtus muriei* Nelson.

Quay (Jour. Mamm., 32:95, February 15, 1951) identified fifty-eight specimens from the Seward Peninsula of Alaska as *Microtus miurus oreas* Osgood. Through the courtesy of Dr. Charles P. Lyman, fifteen of Quay's specimens in the Museum of Comparative Zoology at Harvard College have been examined by one of us (Hall). These specimens are as follows: Lava Lake (43378, 43379,

43381, 43382, 43386, 43467 and 43478); Mt. Boyan (43384, 43385, 43463 and 43477); Anvil Hill [= Peak], Cooper Gulch (43377, 43464 and 43473); _____? Lake, 43383. Although we are not prepared to say that these specimens are *M. m. muriei,* they seem to resemble *M. m. muriei* as closely as they do any other named form and we here refer them to that subspecies.

The facts are that a critical taxonomic study of the American specimens of the subgenus *Stenocranius* is required in order to ascertain the geographic variation. One of us (Hall) has examined the holotypes of the kinds named from Alaska, and the material listed by R. Baker (Univ. Kansas Publ. Mus. Nat. Hist., 5:109) of the two kinds named from Canada. The degree and nature of the variation shown by these specimens lead us to the conclusion that all are of a single species. If the American mouse is specifically distinct from any of the previously named Asiatic species—at this writing we lack material to decide this question—the named kinds from the mainland of the New World may stand as follows:

Microtus miurus andersoni Rand.

1945. *Microtus andersoni* Rand, Bull. Nat. Mus. Canada, 99:42, prior to June 20, type from near headwaters of Little Keel River, 5500 ft., 82 mi. W Mackenzie River on Canol Road, Mackenzie.

Microtus miurus cantator Anderson.

1947. *Microtus cantator* Anderson, Bull. Nat. Mus. Canada, 102:161, January 24, type from mountain top near Tepee Lake, 61° 35′ N, 140° 22′ W, N slope Elias Range, Yukon Terr.

Microtus miurus miurus Osgood.

1901. *Microtus miurus* Osgood, N. Amer. Fauna, 21:64, September 26, type from head of Bear Creek, in mts. near Hope City, Turnagain Arm, Cook Inlet, Alaska.

Microtus miurus muriei Nelson.

1931. *Microtus muriei* Nelson, Jour. Mamm., 12:311, August 24, type from Kutuk River (tributary of Alatna River), Endicott Mts., Alaska.

1950. *Microtus miurus paneaki* Rausch, Jour. Washington Acad. Sci., 40: 135, April 21, type from Tolugak Lake (lat. 68° 24′ N, long. 152° 10′), Brooks Range, Alaska.

Microtus miurus oreas Osgood.

1907. *Microtus miurus oreas* Osgood, Proc. Biol. Soc. Washington, 20:61, April 18, type from Toklat River, Alaskan Range, Alaska.

Transmitted July 8, 1952.

The Subspecific Status of Two Central American Sloths

BY

E. RAYMOND HALL and KEITH R. KELSON

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The Subspecific Status of Two Central American Sloths

BY

E. RAYMOND HALL and KEITH R. KELSON

New name combinations for two kinds of Central American sloths that heretofore have stood in the literature as nominal species are given below, along with the evidence supporting their relegation to subspecific rank. Research assistance has been provided from a contract (NR 161-791) between the Office of Naval Research, Department of the Navy, and the University of Kansas.

Bradypus griseus ignavus Goldman

Goldman (Smiths. Misc. Coll., 60(22): 1, February 28, 1913) named the three-toed sloth from extreme eastern Panamá (Marraganti: 1 specimen, the type) and northwestern Colombia (Atrato River: 2 specimens) as *Bradypus ignavus.* He characterized the newly-named species as differing from *Bradypus griseus* (type locality Cordillera de Chucu, Veragua, Panamá) and *Bradypus castaneiceps* (type locality, Chontales, Niracagua) in "nasals shorter, with anterior border concave or emarginate, the emargination deepest at median suture; squamosal arm of zygoma broader, more rounded, less acutely pointed anteriorly; palate less deeply grooved posteriorly; symphysis of mandible less produced anteriorly beyond plane of first molars." Later, Goldman (Smiths. Misc. Coll., 69(5): 57-58, April 24, 1920) arranged *Bradypus castaneiceps* as a subspecies of *B. griseus,* reaffirmed the full specific identity of *Bradypus ignavus,* and identified specimens from Tapalisa, Cituro, and Real de Santa Maria, all in eastern Panamá, as belonging to *B. ignavus.*

In order to satisfy ourselves about the taxonomic relationship of *B. ignavus* to *B. griseus,* we have examined the following materials in the American Museum of Natural History: *ignavus*: Panamá: Cituro (No. 38191), Tapalisa (No. 38102), Real de Santa Maria (Nos. 37619-37621); *griseus*: Panamá: La Chorrera (No. 31427); Costa Rica: Juan Viñas (No. 2824), Palmar (No. 139313), Vijagual, San Carlos (No. 139833); *castaneiceps*: Nicaragua: Chontales (Nos. 28477 and 28478).

The specimens from Real de Santa Maria, Tapalisa, and Cituro, average darker than all others, but this darkness is approached in certain specimens of *griseus* (for example, No. 139833, from Vijagual, San Carlos). The broader, more rounded and less acutely pointed squamosal arm of the zygoma supposedly characteristic of *ignavus* is matched in certain specimens of *griseus* (for example, in No. 2824 from Juan Viñas, Costa Rica) and the character is variable among specimens referred to *ignavus;* the shape of the squamosal arm is of doubtful taxonomic worth in the present connection. The depth of the grooving on the palate seems to vary with age and is of questionable value taxonomically. The emarginate nasals of *ignavus* are matched in *griseus* (No. 139833) from Vijagual, San Carlos, Costa Rica. The extension of the anterior symphyseal region of the mandible is short in *ignavus*; the specimen with the longest extension (No. 37621 from El Real), however, has the extension only barely shorter than does No. 139933 of *griseus* from Vijagual, San Carlos, Costa Rica. In brief, while we see the characters of *ignavus* as set forth by Goldman (*op. cit.*), we find them to be of only an average sort and not pronounced. Further, a specimen (No. 139833) from Vijagual, San Carlos, Costa Rica, provides a morphological intergrade between *griseus* and *ignavus.* Accordingly, we arrange *ignavus* as a subspecies of *griseus;* the name of the animal from extreme eastern Panamá should stand as *Bradypus griseus ignavus* Goldman, 1913.

Cyclopes didactylus mexicanus Hollister

Hollister (Proc. Biol. Soc. Washington, 127:210, October 31, 1914) named *Cyclopes mexicanus*, on the basis of light-golden upper parts and large, especially broad, auditory bullae, as specifically distinct from *Cyclopes dorsalis* Gray (= *Cyclopes tridactylus dorsalis* Gray). Our comparisons and examination of the specimens used by Hollister and a few other specimens acquired since 1914 convince us that *C. mexicanus* is taxonomically valid and that Hollister, in general, correctly indicated its diagnostic characters. Nevertheless, there is considerable evidence that *C. mexicanus* is only subspecifically distinct from *C. dorsalis.* In the first place, an adult *C. dorsalis,* not seen by Hollister, from El Banco, Chiriquí, Panamá (No. 248343 USBS), has more inflated, although narrower, auditory bullae than do specimens of *C. mexicanus.* In the second place, the two specimens mentioned by Hollister (*loc. cit.*) as from "Tabasco and southern Vera Cruz" actually are both from Tabasco

(No. 100040 USBS from Teapa, and No. 100174 USBS from Montecristo). Each, as Hollister indicated, is darker on the upper parts than his other referred specimens (two others from Montecristo in Tabasco and another from El Salto in Chiapas). To us this suggests intergradation with *C. dorsalis.* Incidentally, the specimen that Hollister mentioned from Veracruz (No. 78111 USBS, from Minatitlan), and that he indicated as having dark upper parts, really has light upper parts. Third, a skin from Petén, Libertad, Guatemala (Harry Malleis field No. 504, immature ♀), that the late Major E. A. Goldman and one of us (Hall) once examined, has considerable dark brown on the chin, throat and midventral line, as well as a dark mid-dorsal stripe. The specimen is intermediate in color, as well as geographically, between *C. t. dorsalis* and *C. mexicanus,* although referable to the latter. Taken together, the above evidence indicates subspecific status for the northern, Mexican, animal and we conclude that it should stand as *Cyclopes tridactylus mexicanus* Hollister.

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Comments on the Taxonomy and Geographic Distribution of Some North American Marsupials, Insectivores and Carnivores

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BY

E. RAYMOND HALL and KEITH R. KELSON

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Comments on the Taxonomy and Geographic Distribution of Some North American Marsupials, Insectivores and Carnivores

BY

E. RAYMOND HALL and KEITH R. KELSON

In preparing maps showing the geographic distribution of North American mammals we have found in the literature conflicting statements and questionable identifications, which have led us to examine the specimens concerned with results as set forth below. Our studies have been aided by a contract (NR 161-791) between the Office of Naval Research, Department of the Navy, and the University of Kansas. Grateful acknowledgment is made to the persons in charge of the several collections of mammals consulted for permission to examine and study the specimens therein.

Didelphis marsupialis californica Bennett

From Cuernavaca, Morelos, Hooper (Jour. Mamm., 28:43, February 1, 1947) lists a specimen, as he says, on purely geographic grounds, as of the subspecies *Didelphis mesamericana tabascensis.* We have examined this specimen, an unsexed skull-only, which falls within the range of individual variation of *Didelphis marsupialis californica* and refer the specimen to that subspecies.

Didelphis marsupialis etensis J. A. Allen

From El Muñeco, Costa Rica, Harris (Occas. Papers, Mus. Zool. Univ. Michigan, no. 476:7, October 8, 1943) lists as *Didelphis richmondi* a specimen (♂ , No. 67550 U. M.). Our examination of the specimen shows it to be within the range of individual variation of populations that have been referred to *D. m. etensis* from adjoining areas. We identify the specimen as *Didelphis marsupialis etensis.*

Didelphis marsupialis tabascensis J. A. Allen

From Minatitlán, Veracruz, J. A. Allen (Bull. Amer. Mus. Nat. Hist., 14:168, June 15) listed a specimen under the name *Didelphis marsupialis* [in the trinomial sense] instead of under the name *Didelphis marsupialis tabascensis,* which would be expected, on geographic grounds, to apply. The specimen is No. 78123, U. S. Nat. Mus., Biol. Surv. Coll. Our examination of the specimen re-

veals that it is within the range of individual variation of *Didelphis marsupialis tabascensis* and we identify the specimen as of that subspecies. From Yaruca, Honduras, Bangs (Bull. Mus. Comp. Zool., 39:157, July, 1903) doubtfully listed as *Didelphis yucatanensis* a specimen, No. 10611, M. C. Z. Our examination of the specimen indicates that it is within the range of variation expectable in *Didelphis marsupialis tabascensis*, known from surrounding areas, and we identify the specimen as *Didelphis marsupialis tabascensis*.

Didelphis marsupialis virginiana Kerr

J. A. Allen (Bull. Amer. Mus. Nat. Hist., 14:166, May 28, 1901) and A. H. Howell (N. Amer. Fauna, 45:20, October 28, 1921) have identified four skulls from Sylacuga, Alabama, as *Didelphis virginiana pigra*. The two subspecies *virginiana* and *pigra* are not known to differ cranially. We have, however, examined the skulls which are Nos. 44057-44060 in the U. S. Nat. Mus., Biol. Surv. Coll. Because they are from a place north of other localities (Auburn and Greenboro, Alabama) from which the subspecies *virginiana* has been recorded, and within the geographic range of *virginiana*, we identify the specimens as *Didelphis marsupialis virginiana*.

Sycamore Creek (synonymous with Fort Worth), Texas, is a place from which J. A. Allen (*op. cit.*:173) recorded a specimen as *Didelphis marsupialis texensis*. This specimen (No. 24359/31765 U. S. Nat. Mus., Biol. Surv. Coll.) is in the black color-phase. There are only a few white hairs on the hind feet, and the basal fourth of the tail is black. The black phase occurs all through the range of the species *D. marsupialis* and our examination of the specimen reveals no characters by which it can be distinguished from *D. m. virginiana* of the surrounding region and we accordingly identify the specimen as *Didelphis marsupialis virginiana*.

Didelphis marsupialis pigra Bangs

Davis (Jour. Mamm., 25:375, December 12, 1944) was one writer who presented evidence that *Didelphis virginiana* (through its subspecies *virginiana* or *pigra* or both) was only subspecifically distinct from the species *Didelphis mesembrinus* (= *D. marsupialis*) through the subspecies *texensis*. Davis, however, did not actually employ a name combination that would enforce his conclusion and he remarked that he had not seen specimens which showed actual intergradation in the color of the toes. As the remarks below will show, Davis (*loc. cit.*) was correct in his supposition that J. A. Allen had seen such specimens.

Deming Station, Matagordo, and Velasco, Texas, are three places from which J. A. Allen (Bull. Amer. Mus. Nat. Hist., 14:162, May 28, 1901) listed specimens as *Didelphis virginiana*. The specimens concerned are in the Biological Surveys Collection of the U. S. Nat. Museum and bear catalogue numbers as follows: Deming Station, 32430/44266, 32432/44268, 32433/44269; Matagordo, 32431/44267; Velasco, 32812/44833. In each specimen the tail is shorter than the head and body. The specimen from Velasco is semi-black, has the basal tenth of the tail black and there is no white on the ears or tail. The specimen from Matagordo is grayish, has the basal fifth of the tail black, ears black, the right hind foot black, but there is some white on the toes of the left hind foot and on each of the forefeet. Of the three specimens from Deming Station, all are in the gray color-phase. The first has the tail black only as far from the base as there is hair and there is considerable whitish on the hind toes. The second specimen has the basal fifth of the tail black and a slight amount of whitish on the hind toes. The third specimen has the basal third of the tail black and the toes are all black. In the sum total of their characters the specimens mentioned above are referable to *Didelphis marsupialis pigra*. These five specimens, and indeed the three from Deming Station alone, show intergradation in coloration of the feet between *Didelphis marsupialis texensis* and *Didelphis virginiana pigra*. Probably there is three-way intergradation here at Deming Station in that *D. v. virginiana* immediately to the north is involved. The specimens mentioned above, along with the information recorded by Davis (*loc. cit.*) and other authors (for example, J. A. Allen, *loc. cit.*, and Bull. Amer. Mus. Nat. Hist., 16:249-279, August 18, 1902), give basis for arranging the North American *Didelphis* as follows:

Didelphis marsupialis virginiana Kerr.

1792. *Didelphis virginiana* Kerr, Animal Kingdom, p. 193, type locality Virginia.

Didelphis marsupialis pigra Bangs.

1898. *Didelphis virginiana pigra* Bangs, Proc. Boston Soc. Nat. Hist., 28:172, March, type from Oak Lodge, opposite Micco, Brevard Co., Florida.

Didelphis marsupialis texensis J. A. Allen.

1901. *Didelphis marsupialis texensis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 14:172, June 15, type from Brownsville, Cameron County, Texas.

Didelphis marsupialis californica Bennett.

1833. *Didelphis Californica* Bennett, Proc. Zool. Soc. London, p. 40, May 17, type probably from northwestern part of present Republic of Mexico.

1924. *Didelphis mesamericana mesamericana,* Miller. Bull. U. S. Nat. Mus., 128:3, April 29, 1924, and authors. Type locality, northern Mexico. (*Did[elphys]. mesamericana* Oken, Lehrbuch d. natur-

gesch., pt. 3, vol. 2, p. 1152, 1816, along with other names from Oken 1816, is judged to be unavailable under current rules of zoological nomenclature.)

Didelphis marsupialis tabascensis J. A. Allen.

1901. *Didelphis marsupialis tabascensis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 14:173, June 15, type from Teapa, Tabasco.

Didelphis marsupialis yucatanensis J. A. Allen.

1901. *Didelphis yucatanensis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 14:178, June 15, type from Chichenitza, Yucatán.

Didelphis marsupialis cozumelae Merriam.

1901. *Didelphis yucatanensis cozumelae* Merriam, Proc. Biol. Soc. Washington, 14:101, July 19, type from Cozumel Island, Yucatan.

Didelphis marsupialis richmondi J. A. Allen.

1901. *Didelphis richmondi* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 14: 175, June 15, type from Greytown, Nicaragua.

1920. *D[idelphis], m[arsupialis], richmondi,* Goldman, Smithsonian Misc. Coll., 69(5):46, April 24.

Didelphis marsupialis etensis J. A. Allen.

1902. *Didelphis marsupialis etensis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 16:262, August 18, type from Eten, Piura, Perú.

Didelphis marsupialis battyi Thomas.

1902. *Didelphis marsupialis battyi* Thomas, Novitates Zoologicae, 9:137, April 10, type from Coiba Island, Panamá.

Didelphis marsupialis particeps Goldman.

1917. *Didelphis marsupialis particeps* Goldman, Proc. Biol. Soc. Washington, 30:107, May 23, type from San Miguel Island, Panamá.

Didelphis marsupialis insularis J. A. Allen.

1902. *Didelphis marsupialis insularis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 16:259, August 18, type from Caparo, Trinidad.

In listing the subspecific names given immediately above we are aware of the possibility that a thorough study of the geographic variation in *Didelphis marsupialis* may contract or expand the list of recognizable subspecies. We are aware also that Hershkovitz (Fieldiana: Zoology, 31 (No. 47):548, July 10, 1951) has arranged several of the subspecific names listed immediately above as synonyms of *Didelphis marsupialis californica* Bennett. We have not employed his arrangement because he has not given proof that the currently recognized subspecies are indistinguishable.

Caluromys derbianus canus (Matschie)

Matschie (Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin, Jahrgang 1917, p. 284 (for April), September, 1917) applied the name *Micoureus canus* to a specimen on which the locality was no more precise than Nicaragua. Comparison of Matschie's description with specimens in the United States National Museum (including the holotype of *Philander centralis* Hollister and referred specimens of *Philander laniger pallidus* Thomas) reveals that Matschie's specimen was intermediate in coloration between the other two kinds of woolly opossums named above and that there is nothing distinctive, in the specific sense, in the cranial measurements which Matschie published (*op. cit.*). *M. canus,*

therefore, may be merely an intergrade between the two previously named woolly opossums (*C. d. centralis* and *C. d. pallidus*), an individual variant of a previously named kind, say, *C. d. pallidus*, or a valid subspecies. If it is a recognizable subspecies, it probably comes from somewhere in the eastern half of Nicaragua. As a means of handling the name, *Micoureus canus* Matschie, we tentatively place it as a subspecies of the species *Caluromys derbianus*. The name may, therefore, stand as *Caluromys derbianus canus* (Matschie), with type locality in Guatemala.

Caluromys derbianus fervidus (Thomas)

Elliott (Field Columb. Mus. Nat. Hist., Publ. No. 115, Zool. Ser., 8:5, 1907) lists as *Caluromys laniger pallidus* a specimen from Honduras that was acquired for the Field Columbian Museum (= Chicago Natural History Museum) by purchase from Ward's Natural Science Establishment of Rochester, New York. On August 4, 1951, in the Chicago Natural History Museum, we found in the catalogue of the collection of Recent mammals an entry for a male *Caluromys* bearing catalogue number 6 and listed as from "San Pedro Sula [Honduras]. From Wards. Mounted". In the collection of study specimens there is no specimen from Honduras that was purchased from Ward's, mounted or unmounted. In the sealed, glass-fronted, exhibit cases of mammals on display there is one, and only one, *Caluromys*. It is presumed to be specimen No. 6. This specimen is not *C. d. pallidus* because it is too dark. It could be *Caluromys derbianus fervidus* and we tentatively refer it to that subspecies.

Caluromys derbianus pallidus (Thomas)

From Puntarenas, Costa Rica, Harris (Occas. Papers Mus. Zool. Univ. Michigan, 476:7, October 8, 1943) listed as *Caluromys laniger centralis* a female, skull and skin, No. 62702 in the Museum of Zoology of the University of Michigan. We have examined this specimen, the color of which is darker than in some other specimens of *C. d. pallidus* but lighter than that of specimens of *C. d. centralis* (for example, specimens from Turrialba, Costa Rica) and on basis of color we refer No. 62702 to *Caluromys derbianus pallidus*.

Scalopus aquaticus aereus (Bangs)

Bangs' (Proc. Biol. Soc. Washington, 10:138, December 28, 1896) name *S. a. aereus* was based on a single specimen that shows more than an average amount of coppery color. Jackson (N. Amer.

Fauna, 38:52, September 30, 1915) and subsequent authors accord full specific rank to the specimen under the name *Scalopus aereus.* Blair (Amer. Midland Nat., 22:98, July, 1939) recorded, from the type locality of *Scalopus aereus,* normally colored individuals of *Scalopus aquaticus pulcher* Jackson. Previously, Scheffer (Kansas State Agric. College, Exp. Bull., 168:4, August 1, 1910) reported that in his examination of 100 individuals of *Scalops* [= *Scalopus*] *aquaticus* from Manhattan, Kansas, there were two individuals "that were suffused all over with rich golden brown." Because our examination of the type specimen of *Scalops texanus aereus* Bangs reveals no features additional to coppery color that differentiate *aereus* from other individuals of *Scalopus aquaticus pulcher* Jackson (Proc. Biol. Soc. Washington, 27:19, February 2, 1914) we conclude that Jackson's name and Bangs' name (*Scalops texanus aereus*) apply to the same subspecies. Bangs' name has priority and the correct name, therefore, for the populations of moles that in recent years have been designated as *Scalopus aereus* Bangs and *Scalopus aquaticus pulcher* Jackson will be *Scalopus aquaticus aereus* (Bangs). This name combination was previously used by Miller (U. S. Nat. Mus. Bull., 79:8, December 31, 1912).

Scalopus aquaticus australis (Chapman)

Quay (Jour. Mamm., 30:66, February 14, 1949) recorded *Scalopus aquaticus* from Springhill Plantation, 10 miles south-southwest of Thomasville, Georgia. He stated that the specimens were intermediate between the subspecies *S. a. australis* and *S. a. howelli,* but did not refer the specimens to either subspecies. The locality whence the material was obtained is approximately half way between the geographic ranges, as previously known, of *S. a. australis* and *S. a. howelli* (see Jackson, N. Amer. Fauna, 38, September 30, 1915).

The specimens recorded by Quay probably are two females in the Cleveland Museum of Natural History bearing Catalogue Nos. 18136 and 18262 and labeled as from Springhill Plantation, Thomas County, Georgia. We have examined these specimens and find that they resemble *S. a. howelli* in narrowness across the upper tooth-rows, but that they resemble *S. a. australis* in length of tail (22, 24), in shortness of maxillary tooth-row (9.5, 9.5), and in convex dorsal outline of the skull. Accordingly, we refer the specimens to *Scalopus aquaticus australis.*

Sorex cinereus cinereus Kerr

In his revision of the American long-tailed shrews, Jackson (N. Amer. Fauna, 51, vi + 238, 13 pls., 24 figs., July 24, 1928) referred specimens of *Sorex cinereus* from Tyonek, Cook Inlet, Alaska, to the subspecies *S. c. cinereus* (*op. cit.*: 46) and one specimen from Chester Creek, Anchorage, Alaska, to the subspecies *S. c. hollisteri* (*op. cit.*: 56). Thus, the geographic ranges of the two subspecies would seem to overlap around the northern shores of Cook Inlet. In an attempt to resolve this seemingly anomalous distribution, we have examined pertinent materials in the Biological Surveys Collection, U. S. National Museum. We agree with Jackson (*op. cit.*) that the series of specimens from Tyonek is readily referable to *S. c. cinereus*. To our eye, however, the specimen, No. 232691, from Anchorage is referable to *Sorex cinereus cinereus*, rather than to *S. c. hollisteri*. The reference is made on the basis of the darker color, especially of the underparts. In this specimen, other characters that distinguish the two mentioned subspecies are not apparent, probably because it is relatively young; the teeth show only slight wear.

Sorex trowbridgii humboldtensis Jackson

In his account of the long-tailed shrews, Jackson (N. Amer. Fauna, 51:98, July 24, 1928) listed under specimens examined of *Sorex trowbridgii montereyensis* four specimens from 7 mi. N Hardy, Mendocino Co., California. Under his account of the subspecies *S. t. humboldtensis*, however, he (*op. cit.*:97) mentions that specimens (seemingly the same four) from 7 mi. N Hardy "have shorter tails than typical representatives of *humboldtensis*, but in color and cranial characters they are similar to this [*humboltensis*] subspecies." We conclude, therefore, that the specimens mentioned were inadvertently listed as *S. t. montereyensis* and are *Sorex trowbridgii humboldtensis*. This conclusion is supported by the fact that the locality concerned, 7 mi. N Hardy, is within the geographic range assigned to *S. t. humboldtensis* by Jackson (*op. cit.*:97); his southern records of occurrence of *S. t. humboldtensis* are Sherwood and Mendocino, both in Mendocino County, California. Our conclusion is further supported by Grinnell's (Univ. California Publ. Zool., 40(2):80, September 26, 1933) statement of the range of *S. t. montereyensis* as "from southern Mendocino County south . . . ."

Blarina brevicauda churchi Bole and Moulthrop

Kellogg (Proc. U. S. Nat. Mus., 86:253, February 14, 1939) tentatively referred specimens of the short-tailed shrew from the mountainous parts of eastern Tennessee to the subspecies *Blarina brevicauda talpoides*, with the remark that they were unlike specimens of that subspecies obtained in eastern and southern West Virginia. Subsequently, Bole and Moulthrop (Sci. Publ. Cleveland Mus. Nat. Hist., 5:109, September 11, 1942) named the subspecies *Blarina brevicauda churchi* with type locality at Roan Mountain, North Carolina. We have examined the specimens in the U. S. National Museum recorded by Kellogg (*loc. cit.*) from the following localities: Shady Valley, 2900 ft. (Catalogue No. 267182); Holston Mtn., 4 mi. NE Shady Valley, 3800 ft. (Nos. 267176-267178, 267180, and 267181); Holston Mtn., 3 mi. NE Shady Valley, 3000 ft. (No. 267179); Roan Mtn., (Nos. 267469-267475); Mt. Guyot, 6300 ft. (No. 267183); 4½ mi. SE Cosby, 3300 and 3400 ft. (Nos. 267184 and 267185); and Snake Den Mtn., 3800 ft. (No. 267186). Among named kinds of *Blarina brevicauda*, we find these specimens to resemble most closely *Blarina brevicauda churchi* and so refer them. They are readily distinguishable from specimens of *B. b. kirtlandi*, that occurs farther north in the same mountain range, by larger size and longer tail. Incidentally, in the specimens that we have examined, we do not find that *B. b. churchi* is darker colored than other subspecies of *Blarina brevicauda; B. b. churchi*, to us, is indistinguishable in color from *B. b. kirtlandi*. Bole and Moulthrop (*op. cit.*) thought that *B. b. churchi* was notably darker than other subspecies from adjoining areas.

Blarina brevicauda carolinensis (Bachman)

Blair (Amer. Midland Nat., 22(1):99, July, 1939) referred specimens of the short-tailed shrew from the Arbuckle Mountain area of Oklahoma to *Blarina brevicauda hulophaga* and specimens from Mohawk Park, Tulsa County, Oklahoma, to *B. b. carolinensis*. Later Bole and Moulthrop (Sci. Publs. Cleveland Mus. Nat. Hist., 5:108, September 11, 1942) saw two of the specimens from Mohawk Park and assigned them to *B. b. hulophaga*. According to the most recent published account, therefore, *B. b. hulophaga* would seem to have a peculiarly discontinuous geographic range. We have examined the material seen by Blair and by Bole and Moulthrop (Nos. 75946, 75947, 75643, Mus. Zool. Univ. Michigan) in an attempt to form our own judgment as to their subspecific identity. The teeth of No. 75946 are well worn, whereas the teeth of the

other two are scarcely worn. We are unable to distinguish No. 75946 from topotypes of *B. b. carolinensis* by size, color, or cranial features. The two younger specimens are smaller and paler, but do not agree with the description of *B. b. hulophaga*. The nearly-complete narrow, white girdle of No. 75947 is clearly an individual variation. We assign the animals to *Blarina brevicauda carolinensis* (Bachman) as did Blair (*loc. cit.*).

Blarina brevicauda minima Lowery

Bailey (N. Amer. Fauna, 25:207, October 24, 1905) identified as *Blarina brevicauda carolinensis* one specimen from Joaquin and two specimens from Big Thicket, 8 mi. NE Sour Lake, both localities in eastern Texas. Strecker and Williams (Jour. Mamm., 10:259, August 10, 1929) later recorded the specimens again under the same name. The subsequent naming of *B. b. plumbea* from Aransas National Wildlife Refuge, Aransas County, Texas (Davis, Jour. Mamm., 22(3):317, August 14, 1941) and *B. b. minima* from Louisiana (Lowery, Occas. Papers Mus. Zool., Louisiana St. Univ., 13: 218, November 22, 1943) leaves the identity of the specimens from eastern Texas in doubt. We have examined the following specimens in the Biological Surveys Collection, U. S. National Museum: No. 117372, from Joaquin; No. 136407, from 7 mi. NE Sour Lake; and No. 136788, from 8 mi. NE Sour Lake. We judge these to be the specimens referred to by Bailey (*loc. cit.*). We find that they are indistinguishable from specimens of *Blarina brevicauda minima* and they seem to differ from *B. b. plumbea* in being chestnut rather than plumbeous in color and in lacking the highly-arched posterior border of the palate. They are easily distinguished from *B. b. carolinensis* by their chestnut, rather than slaty-black, color and small size. They are distinguishable from *B. b. hulophaga*, to which they might conceivably be referred on geographic grounds, by their color and small size. We refer them to *Blarina brevicauda minima* Lowery.

Spilogale angustifrons angustifrons A. H. Howell

In his "Revision of the skunks of the genus Spilogale" (N. Amer. Fauna, 26, November 24, 1906) A. H. Howell identified certain specimens in the United States National Museum as follows:

Spilogale leucoparia, ♂ sad. 55585 from Tulancingo, Hidalgo (*op. cit.*: 21).

Spilogale gracilis, ♂ sad. 88154 from San Sebastian in Jalisco, ♂ ad. 79017 from Lagos in Jalisco, ♂ ad. 47177 from Pátzcuaro in Michoacán (*op. cit.*:23).

Spilogale ambigua, ♂ ad. 35667/20437 from Barranca Ibarra in Jalisco, ♂ yg. 120101 from Ocotlán in Jalisco (*op. cit.*:25).

Hall and Villa (Univ. Kansas Publ., Mus. Nat. Hist., 1:448, December 27, 1949) inferred that No. 47177 from Pátzcuaro was instead referable to *Spilogale angustifrons angustifrons*. Our examination of No. 47177 and of each of the other specimens mentioned by catalogue number immediately above leads us to conclude that they all are of one species, and that, among named kinds of *Spilogale*, they should be referred to the subspecies *Spilogale angustifrons angustifrons* Howell.

Our examination of all of the specimens that Howell (*op. cit.*) identified as *Spilogale [angustifrons] angustifrons* reveals that none of the specimens from the type locality had attained full adult stature; the holotype is a subadult and the other specimens from the type locality are even younger. The small size of these specimens from the type locality seems to have mislead Howell into thinking that they were taxonomically distinct from the larger specimens—those from Jalisco, Michoacán and Hidalgo—that he identified as other kinds.

Spilogale gracilis gracilis Merriam

In the genus *Spilogale* four specific names, concerning the status of which we have been uncertain, are listed below in the order of their appearance in the literature.

1890. *Spilogale gracilis* Merriam, N. Amer. Fauna, 3:83, September 11, type from bottom of canyon, Grand Canyon, Arizona.

1890. *Spilogale leucoparia* Merriam, N. Amer. Fauna, 4:11, October 8, type from Mason, Mason County, Texas.

1891. *Spilogale phenax arizonae* Mearns, Bull. Amer. Mus. Nat. Hist., 3: 256, June 5, type from near Fort Verde, Yavapai County, Arizona.

1897. *Spilogale ambigua* Mearns, Preliminary diagnoses of new mammals . . . from the Mexican boundary line, p. 3, January 12 [reprinted in Proc. U. S. Nat. Mus., 20:460, December 24, 1897], type from summit of Eagle Cliff Mtn., 2 mi. S of Monument No. 5 of Emory's Survey which, according to Miller (U. S. Nat. Mus. Bull., 128:134, April 29, 1924), is "Eagle Mountain, Chihuahua, Mexico, about four miles south of Dona Ana County, New Mexico."

In 1906 (N. Amer. Fauna, 26:1-55, 10 pls., November 24) A. H. Howell's "Revision of the skunks of the genus Spilogale" was published and the four names listed above were retained by him as applying to four species (not subspecies). His map (*op. cit.*, pl. 1) showing the geographic distribution of the four kinds looks reasonable enough at first inspection and does not indicate any overlapping of the geographic ranges of the species in question, but if a map be made by plotting the localities of occurrence recorded by Howell (*op. cit.*), for specimens examined by him, a notably different geographic distribution is shown. For one thing the geo-

graphic ranges of *gracilis, leucoparia, arizonae* and *ambigua* coincide over a considerable part of Arizona. Also, specimens collected in recent years from Arizona and adjoining areas do not readily fit into the "species" recognized by Howell; some specimens are structurally intermediate between two or more of these species and other specimens combine the diagnostic characters ascribed to two or more of the alleged species. For these and other reasons a re-appraisal of the application of the names mentioned above long has been indicated.

Before re-appraising the names it is pertinent to recall that Howell's paper in 1906 on *Spilogale* was only the second revisionary paper that he prepared. It was prepared by a man who at that time lacked much taxonomic experience, and who held to a morphotype concept. Howell worked under the guidance, in the literal sense, of Dr. C. Hart Merriam. The concept of species and subspecies held by Merriam fortunately was recorded by him (Jour. Mamm., 1:6-9, November 28, 1919). Merriam's reliance on degree of difference and his disregard of intergradation were naturally (and necessarily, we think, in Howell's work in 1906) adopted by Howell. For example, of six specimens from Point Reyes in west-central California, a place less than ten miles from the type locality of *Spilogale phenax phenax*, Howell (*op. cit.*:33) assigned one specimen to the subspecies *Spilogale phenax latifrons*! *S. p. latifrons* occurs in Oregon and in northern California—no nearer than 200 miles to Point Reyes. Howell's assignment of this specimen to *S. p. latifrons* was not a *lapsus*, as persons with the modern (geographic) concept of a subspecies would be likely to suppose. Howell's assignment of the one specimen to *S. p. latifrons* and the other five specimens to *S. p. phenax* was intentional, as he told one of us (Hall). He explained that he relied upon the morphological characters of the individual animal instead of upon the morphological characters of a population of animals. To him, therefore, there was nothing inconsistent in his procedure in 1906. Also, variation that was the result of difference in age and variation that was the result of individual deviation were not understood, or at least not taken into account, by Howell in 1906, nor by Merriam in 1890. For example, Merriam selected the most extensively white specimen available to him for the holotype of *Spilogale leucoparia*. He, and Howell in 1906, used the extensiveness of the white areas of that particular specimen (see fig. 3, pl. 2, N. Amer. Fauna, 26, 1906) as a character diagnostic of the "species" *S. leucoparia* al-

though each of the authors had available two other specimens of *S. leucoparia* from the type locality, and all of the other referred specimens in the United States National Museum, that were less extensively white than the holotype. The *individual specimen* was the primary basis for the species or subspecies and one selected specimen alone often was used in making comparisons between a given named kind and some other species or subspecies. Also, be it remembered, degree of difference, and not presence or absence of intergradation, was the basis on which subspecific *versus* specific rank was accorded to a named kind of animal. Howell wrote on the labels of some specimens of *Spilogale* "not typical" when the individuals differed from the type specimen in features that owe their existence to individual variation, and he wrote the same words on the labels of other specimens that had not yet developed mastoidal crests because the animals were not yet adult.

Anyone who examines the specimens that Howell used will do well to bear in mind the circumstances noted above concerning Howell's paper of 1906; otherwise the reasons for Howell's identifications of certain specimens can not be understood.

We have examined and compared the holotypes, and other specimens used by Howell. While doing so we have borne in mind the degree of individual variation well shown by each of several series of specimens (for example, that in six adult males, from the Animas Mountains of New Mexico, recorded by V. Bailey, N. Amer. Fauna, 53:339, 1932) and age variation (for example, that shown in specimens of *S. interrupta* from Douglas County, Kansas). The degree of each of these kinds of variation, although considerable, is not extraordinary. That is to say, the variations are of approximately the same degree as we previously have ascertained to exist in *Mephitis mephitis* and in *Mustela frenata,* two species that are in the same family, Mustelidae, as *Spilogale.* As a result of our comparisons, we conclude, first that the four names mentioned at the beginning of this account all pertain to one species, and second that the three names *S. gracilis, S. p. arizonae* and *S. ambigua,* and probably also *S. leucoparia,* were based on individual variations in one subspecies. *S. gracilis* has priority and will apply; the other names are properly to be arranged as synonyms of it, as follows:

1890. *Spilogale gracilis* Merriam, N. Amer. Fauna, 3:83, September 11.
1890. *Spilogale leucoparia* Merriam, N. Amer. Fauna, 4:11, October 8.
1891. *Spilogale phenax arizonae* Mearns, Bull. Amer. Mus. Nat. Hist., 3:256, June 5.
1897. *Spilogale ambigua* Mearns, Preliminary diagnoses of new mammals . . . from the Mexican boundary line, p. 3, January 12.

Some information in support of the above arrangement, along with some other observations on *Spilogale*, are as follows: The type specimen of *Spilogale gracilis* bears on the original skin-label in the handwriting of Vernon Bailey, the collector, the statement that the tail was imperfect. The recorded measurements of 400 for total length and 142 for length of tail, therefore, are presumed to be subject to correction. This presumption and the further circumstance that other specimens from Arizona and New Mexico are as large as specimens of comparable age and sex that we have examined from Nevada and Utah of *Spilogale gracilis saxatilis* Merriam, indicate that S. g. *saxatilis* differs less from the allegedly smaller S. g. *gracilis* than was previously thought. Nevertheless, from north to south (for example, from northern Nevada to southern Arizona) there is an increase in extent of white areas at the expense of black areas of the pelage. As a result, the lateralmost white stripe in S. g. *saxatilis* averages narrower (and often is wanting) than in S. g. *gracilis*. The absence, or narrowness, of the lateralmost white stripe seems to be the principal basis for recognizing S. g. *saxatilis*, just as the tendency to narrow rostrum in Coloradan specimens seems to be the principal basis for recognizing *Spilogale gracilis tenuis* A. H. Howell. Both S. g. *saxatilis* and S. g. *tenuis* are "poorly" differentiated from S. g. *gracilis* and from each other.

The holotype of *Spilogale ambigua* Mearns is slightly smaller than other adult males of comparable age, and the braincase, relative to its width, is slightly deeper than in the average adult male. These variations, nevertheless, are within the range of individual variation, as also are those characterizing the holotype of *Spilogale phenax arizonae* Mearns. The latter specimen is an adult male, with much inflated mastoidal bullae, nearly straight dorsal profile on the skull, relatively shallow braincase, and only slightly worn teeth.

The holotype of *Spilogale leucoparia* Merriam, as pointed out above, is an extreme example of the extensiveness of the white areas of the pelage at the expense of the black areas. This feature occurs more often in the southwestern desert areas of the United States than it does farther north. In addition to the extensiveness of the white markings, the other two characters allegedly distinctive of S. *leucoparia* are broad and much flattened braincase and great degree of inflation of the mastoidal bullae. Although these three

mentioned features do distinguish S. *leucoparia* from S. *indianola* to the eastward, they seem not to set S. *leucoparia* apart from S. *gracilis* to the westward. For example, in Arizona some specimens are extensively white and some others have the braincase flattened and the mastoidal bullae much inflated. V. Bailey (N. Amer. Fauna, 53:339, 1932) refers to a specimen (♂ , No. 147252 USBS) from the head of the Rio Mimbres in New Mexico in which, as our comparisons show, the inflation of the mastoidal bullae exceeds that of any Texan specimen of S. *leucoparia*, the holotype included. Also, at the type locality of S. *leucoparia*, subadult male No. 188467 USNM and adult male No. 188468 USNM are narrower across the mastoidal region than is the holotype. In summary and review, specimens from the eastern part of the range heretofore ascribed to S. *leucoparia* nearly all have much inflated mastoidal bullae whereas less than half of the specimens of *Spilogale* from western New Mexico and Arizona have these bullae as greatly inflated; but, in No. 147252 from the head of the Rio Mimbres of New Mexico the inflation of the bullae is more extreme than in any specimen that we know of that has been referred to S. *leucoparia*.

If intergradation occurs between *Spilogale gracilis gracilis* and *Spilogale indianola* and between one or both of these kinds on the one hand and *Spilogale interrupta* on the other hand, central Texas would be a logical place to collect intergrades. We suppose that such intergradation will be found to occur and that eventually *Spilogale putorius* will be the specific name to apply to all of the Recent subspecies of spotted skunks. Until proof of such intergradation is forthcoming we employ current nomenclature.

Spilogale gracilis microdon A. H. Howell

A. H. Howell (N. Amer. Fauna, 26:31, November 24, 1906) listed as *Spilogale arizonae martirensis* one specimen (♀ sad.-yg., 145886 USBS) from Comondú, which is the type locality of S. *microdon*. Our examination of ♀ No. 145886 convinces us that it is referable to S. *microdon*.

Examination of the materials used by Howell (*op. cit.*) reveals that there is an increase in size of animal and its skull from within the geographic range of S. *g. martirensis* southward to Cape St. Lucas which is the type locality of S. *lucasana*. Specimens of S. *microdon*, which so far has been recorded only from Comondú, the type locality, are, as would be expected, intermediate in size between S. *g. martirensis* and S. *lucasana*. The differential characters of these three named kinds of *Spilogale* are principally those of size,

and we can see no characters judged to be of more than subspecific worth. Consequently the named kinds should stand as:

Spilogale gracilis martirensis Elliott;
Spilogale gracilis microdon A. H. Howell;
Spilogale gracilis lucasana Merriam.

Spilogale gracilis microrhina Hall

When Hall (Jour. Mamm., 7:53, February 15, 1926) named as new *Spilogale phenax microrhina,* he did not mention specimens previously recorded by A. H. Howell (N. Amer. Fauna, 26:32, November 24, 1906) as *Spilogale phenax* from San Bernardino Peak (57026 USBS), La Puerta (99580 USBS), Dulzura (55848, 56173, 56873, 33693/45728, 36291/48656 and 36292/48657) in southern California. On geographic grounds these specimens would be expected to be S. *g. microrhina* although geographically slightly outside the area that could be delimited by Hall's (*op. cit.*) marginal record-stations of occurrence. Our examination of the pertinent specimens reveals that they are *Spilogale gracilis microrhina.* The localities from which the specimens came are, respectively, the northeastern-most, easternmost and southernmost occurrences so far listed for the subspecies.

Conepatus mesoleucus mearnsi Merriam

Examination of the holotypes of *Conepatus filipensis* Merriam, *Conepatus pediculus* Merriam, *Conepatus sonoriensis* Merriam, and *Conepatus mesoleucus mearnsi* Merriam, and other specimens of the two kinds last named, convinces us that all are the same species and that the names should stand as follows: *Conepatus mesoleucus filipensis* Merriam (type locality, Cerro San Felipe, Oaxaca); *Conepatus mesoleucus pediculus* Merriam (Sierra Guadalupe, Coahuila); and *Conepatus mesoleucus sonoriensis* Merriam (Camoa, Río Mayo, Sonora).

One method of designating the ages of individuals in *Conepatus* is to recognize four categories from younger to older, as follows: 1) juvenile—retaining one or more deciduous teeth; 2) young—sutures open and clearly to be seen between bones of the facial part of the skull; 3) subadult — skull of adult form, but lacking sagittal and lambdoidal crests and retaining faint traces of sutures between facial bones; and 4) adult—sutures obliterated, lambdoidal ridge high and temporal ridges (of females) or sagittal crest (of males) prominent.

On this basis of designating age, the holotype of *C. pediculus* is young and nearer the juvenal than the subadult stage. Its small

size is partly the result of its youth. Other than its small size we find no characters to distinguish it from *C. m. mearnsi.* Unfortunately no young male of *C. m. mearnsi* of the same age as the holotype of *C. pediculus* is available. Also, from the general area of the Sierra Guadalupe, Coahuila, only the one specimen of *Conepatus mesoleucus* (the holotype of *C. m. pediculus*) is known. Consequently, we can not yet prove that some young males of *C. m. mearnsi* are as small as the holotype of *C. pediculus.* Because of this lack of proof we tentatively recognize the subspecies *Conepatus mesoleucus pediculus* instead of placing the name *Conepatus pediculus* in the synonomy of *Conepatus mesoleucus mearnsi.*

The holotype of *C. sonoriensis* is a young female, older than the holotype of *C. pediculus,* and approximately midway between the juvenal and subadult stages.

The holotype of *C. filipensis* is an adult male.

We suppose that *C. mesoleucus mesoleucus* Lichtenstein and *C. mesoleucus mearnsi* Merriam on the one hand, and *Conepatus leuconotus leuconotus* Lichtenstein and *C. l. texensis* Merriam on the other hand will be found to intergrade, in which event the name *Conepatus leuconotus,* having page priority over *Conepatus mesoleucus,* will apply to the species. Proof of complete intergradation is not yet available. The one difference between the two that prevents our uniting them as subspecies of one species is the larger size of *C. l. leuconotus* and *C. l. texensis.* Measurements of the smallest adult male and female available to us of *C. l. texensis* and of the largest adult male and female of *C. m. mearnsi* are given below.

Where the geographic ranges of the two species approach one another the only taxonomically significant difference detected by us is in size, *C. leuconotus* being larger than *C. mesoleucus.* Other characters that are useful in separating the two alleged species now are known to vary geographically in a fashion that indicates only subspecific status for the two kinds. For example, three specimens from Laredo, Texas (previously recorded by V. Bailey, N. Amer. Fauna, 25:205, October 24, 1905—Nos. 24839/32237, 24840/32238 and 24842/32245 USBS), bridge the gap in color pattern between *C. l. texensis* to the east and *C. m. mearnsi* to the west. *C. l. texensis* characteristically has the white stripe terminating anteriorly in an obtuse angle, and on the hinder back the area of white is restricted to a narrow line or is wanting. *C. m. mearnsi* characteristically has the white stripe truncate anteriorly and approximately as broad on the hinder back as on the shoulders. In the specimens from Laredo,

the young female, No. 24842, has the white nearly truncate anteriorly (pointed in the other two specimens, adult females). In No. 24839 the area of white on the hinder back is only slightly restricted in width (noticeably restricted but present in the other two specimens).

The proof of intergradation, or the lack of it, between the two alleged species, *Conepatus mearnsi* and *Conepatus leuconotus,* would seem to be profitably sought by obtaining specimens along the Rio Grande in Texas between the Blocker Ranch ("50 miles southeast of Eagle Pass") and Laredo.

Measurements illustrating the size difference between the two alleged species are as follows:

TABLE 1. Measurements of *Conepatus* from Texas

	C. mesoleucus mearnsi			C. leuconotus texensis						
	♂ad. 186455 USNM, Mason, Texas. Type	♂ad. 31970/24575 USBS, Blocker Ranch, Texas	♀ad. 126241 USBS, 8 mi. S Langtry, Texas	♂ad. 47122 USBS, Brownsville, Texas. Type	♂ad. 45132/33129 USBS, Brownsville, Texas	♂yg. 45900/33865 USBS, Brownsville, Texas	♀ad. 47121/34865 USBS, Brownsville, Texas	♀ad 24839/32237 USBS, Laredo, Texas	♀ad. 24840/32328 USBS, Laredo, Texas	♂? sad. 16651 AMNH, Kingsville, Texas
Total length	633	.....	610	800	920	770	670	685	700	.....
Length of tail	.....	.....	269	360	410	300	250	220	260	.....
Length of hind foot	72*	75*	71	74	70	90	65	78	80	.....
Condylobasal length	72.0	72.8	64.5	83.5	78.9	78.2	72.0	75.7	74.5	.....
Zygomatic breadth	51.3	50.1	43.4	55.3	76.8	.....	48.3	49.0	48.0	50.3
Mastoidal breadth	41.0	44.2	37.0	47.3	78.2	43.7	40.5	40.5	40.7	.....
Length of upper tooth-rows	28.9	28.0	25.8	32.7	55.3	30.4	29.9	28.9	29.8	31.8
Outside length of P4	7.3	.....	6.1	8.5	53.2	7.5	7.5	6.6	7.7	7.6
Outside length of M1	7.8	7.0	6.7	9.2	52.7	8.4	8.3	7.6	9.3	9.1
Breadth of M1	7.6	7.0	6.5	9.3	.....	8.6	8.2	7.9	9.4	8.2

* Measured dry.

Conepatus mesoleucus venaticus Goldman

When Goldman (Jour. Mamm., 3:40, February 10, 1921) named *C. m. venaticus* from Arizona he did not mention material which Merriam (Proc. Biol. Soc. Washington, 15:163, August 6, 1902) had recorded from Ft. Verde, Arizona, under the name *Conepatus mesoleucus mearnsi.* This material seems to be specimens in the

American Museum of Natural History of which the two oldest specimens are as follows: No. 2486/1921, male, adult, from Box Cañon, 20 mi. S Ft. Verde; No. 2487/1922, female, subadult, from Verde River, Arizona. Pertinent measurements of these specimens are, respectively, as follows: condylobasal length, 72.4, 68.8; zygomatic breadth, 50.0, 44.2; width of braincase at constriction behind zygomata, 36.4, 33.8; mastoidal breadth, 44.3, 38.4. Comparison of these measurements with those given for *C. m. venaticus* (Goldman, *loc. cit.*) reveals that the specimens concerned agree in narrowness of skull with *C. m. venaticus* (*C. m. mearnsi* is relatively wider) and it is on this basis that we refer the specimens to *Conepatus mesoleucus venaticus*.

Urocyon cinereoargenteus costaricensis Goodwin

J. A. Allen (Bull. Amer. Mus. Nat. Hist., 20:48, February 29, 1904) listed two specimens of gray fox from Pozo Azul, Costa Rica, as *Urocyon guatemalae*. Goodwin, in his "Mammals of Costa Rica" (Bull. Amer. Mus. Nat. Hist., 87(5):271-474, December 31, 1946) did not mention any material from Pozo Azul. We have examined the skull of the adult female (No. 19208 AMNH) taken on July 17, 1902, at Pozo Zul [sic], by M. A. Carriker and find it to be indistinguishable from other specimens of *Urocyon cinereoargenteus costaricensis* to which subspecies we therefore refer the specimen.

Canis lupus griseoalbus Baird

In 1823 Sabine (No. V, Zoological Appendix, p. 654, *In* Narrative of a journey to the shores of the Polar Sea . . . xvi + 768, 30 pls., 4 maps, 1823, London, by John Franklin) applied the name *Canis Lupus-Griseus* to the gray wolf in the vicinity of Cumberland House, Saskatchewan. On the following page (p. 655) he employed the name *Canis Lupus-Albus* for a white wolf obtained at Fort Enterprise, Northwest Territories. In 1937 Goldman (Jour. Mamm., 18(1):45, February 14) did not consider the wolves of the Cumberland House region to be sufficiently different from animals from surrounding areas to warrant nominal separation for them and he placed the name *Canis lupus griseus* Sabine as a synonym of *Canis lupus occidentalis* Simpson. Anderson (Jour. Mamm., 24(3):386, August 17, 1943) revived Sabine's name *griseus* and assigned to *Canis lupus griseus* an extensive geographic range in central Canada. Later, Goldman (Part II, Classification of wolves, p. 395 and 424, *In* The Wolves of North America, American Wildlife Institute, May 29, 1944) by implication, again arranged *griseus* of Sabine as a synonym of *Canis lupus occidentalis* and pointed out

(*op. cit.*:395) that, in any event, the name *griseus* is preoccupied by [*Canis*] *Griseus* Boddaert, 1784 [= *Urocyon cinereoargenteus* (Schreber), 1775]. Still later, Anderson (Bull. 102, Nat. Mus. Canada, p. 54, January 27, 1947) again recognized the subspecies formerly known as *Canis lupus griseus* Sabine, and, because of Boddaert's prior usage of [*Canis*] *griseus*, renamed the subspecies *Canis lupus knightii*. It appears, however, that there is an earlier name available for this subspecies. Goldman (*op. cit.*, 1943:395) points out that "apparently combining the names *Canis* (*Lupus*) *griseus* and *Canis* (*Lupus*) *albus* of Sabine . . . as *Canis occidentalis* var. *griseo-albus*, Baird [Mammals, Repts. Explor. and Surv. for R. R. to Pacific Ocean, Washington, p. 104, vol. 8, (1857) July 14, 1858] seems to have entertained a somewhat composite concept of a widely ranging race varying in color from 'pure white to grizzled gray.' No type was mentioned and the name does not appear to be valid or clearly assignable to the synonomy of any particular race." We agree with Goldman that Baird's concept was a composite one, but Baird's name, *Canis occidentalis* var. *griseo-albus*, was clearly based on the primary names of Sabine (*griseus* and *albus*), of De Kay (*occidentalis*), of Maxmillian (*variabilis*, a synonym of *Canis lupus nubilis*) and of Townsend (*gigas*, a synonym of *Canis lupus fuscus*). Nevertheless, the name *griseo-albus* was applied to, among others, the subspecies of wolf the type locality of which is at Cumberland House, Saskatchewan, and, by restriction, the name *Canis lupus griseoalbus* Baird is available for the subspecies and, of course, antedates *Canis lupus knightii* of Anderson (*op. cit.*, 1947:54). It might be argued that Baird did not intend to propose a new name, but that he did so is a *fait accompli*. *Canis lupus albus* Sabine, 1823, is not available since it is preoccupied by *C*[*anis*]. *Lupus albus* Kerr (Animal Kingdom, Class I, Mammalia, p. 137, 1792), a name applied to the wolf of the Yenisei region of Siberia.

The name and synonomy of the wolf of central Canada should stand as follows:

Canis lupus griseoalbus Baird

1858. *Canis occidentalis*, var. *griseo-albus* Baird, Mammals, Repts. Explor. and Surv. for R. R. to Pacific Ocean, Washington, vol. 8, p. 104 (1857), July 14, 1858, based on *Canis Lupus-Griseus* Sabine 1823 from the vicinity of Cumberland House, Saskatchewan.

1823. *Canis Lupus-Griseus* Sabine, No. V, Zool. App. p. 654, *In* Narrative of a journey to the shores of the Polar Sea . . . by John Franklin (*nec* [*Canis*] *Griseus* Boddaert, Elench. Anim. p. 97, 1794, a synonym of *Urocyon cinereaorgenteus* (Schreber), Säugethiere, p. 92, 1775).

1943. *Canis lupus griseus,* Anderson, Jour. Mamm., 24(3):386, August 17.
1947. *Canis lupus knightii* Anderson, Bull. 102, Nat. Mus. Canada, p. 54, January 24. (A renaming of *Canis Lupus-Griseus* Sabine, 1823.)

The name *Canis Lupus-Albus* Sabine, 1823 (*nec C[anis]. Lupus albus* Kerr, Animal Kingdom, p. 137, 1792) should, of course, be retained as a synonym of *Canis lupus mackenzii* Anderson as arranged by Anderson (Bull. 102, Nat. Mus. Canada, p. 55, January 24, 1947).

When Anderson (*op. cit.*:54) recognized the subspecies *Canis lupus knightii* [= *C. l. griseoalbus*] he made no mention of a specimen of wolf from Norway House, Manitoba, which Goldman (*op. cit.*, 1944:427) had referred to *C. l. occidentalis,* but the subspecific identity of which was placed in doubt by Anderson's action. We have examined the specimen, No. 115995, in the Biological Surveys Collection, U. S. National Museum, and have compared it with specimens, including topotypes, of *C. l. occidentalis* and *C. l. hudsonicus.* The specimen fits the description of *C. l. griseoalbus* and differs from *C. l. occidentalis* in its long and narrow incisive foramina, larger skull, more nearly straight frontal profile (not markedly concave), and slightly higher coronoid processes. Other differences alleged to obtain between these two subspecies offer no assistance in the present case. The specimen from Norway House differs from *C. l. hudsonicus* in larger size of skull and stouter, blunter, postorbital processes, the posterior borders of which turn less abruptly inward. In brief, among currently recognized subspecies, the specimen from Norway House seems best referred to *Canis lupus griseoalbus* Baird.

Canis niger rufus Audubon and Bachman

Goldman (Part II, Classification of wolves, p. 486, *In* The wolves of North America, American Wildlife Institute, May 29, 1944) referred two specimens of the red wolf from Reeds Spring, Missouri, to the subspecies *C. n. gregoryi.* Leopold and Hall (Jour. Mamm., 26(2):143, July 19, 1945) referred wolves from 5 mi. N Gainesville and from 3 mi. N Thomasville, both localities in Missouri, to *C. n. rufus.* The identification of Leopold and Hall was made on the basis of the small size of their specimens and they did not have the advantage of comparative material. The locations of these and other records of occurrence in Missouri and Arkansas suggest that the specimens from Reeds Spring might be better referred to *C. n. rufus,* the more western subspecies. An examination and comparison of the two specimens from Reeds Spring, Nos. 244127 and

244527, Biological Surveys Collection, discloses that they are intergrades between *C. n. rufus* and *C. n. gregoryi*. They resemble *C. n. rufus* in small size and cranial characters, but are more nearly *C. n. gregoryi* in the darker, less brightly rufescent color of the pelage. Being, in this case, more strongly influenced by the size and cranial features than by the color, we consider the animals from Reeds Spring best referred to *Canis niger rufus*.

Transmitted July 15, 1952.

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Comments on the Taxonomy and Geographic Distribution of Some North American Rodents

BY

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Comments on the Taxonomy and Geographic Distribution of Some North American Rodents

BY

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In preparing maps showing the geographic distribution of North American mammals we have found in the literature conflicting statements concerning the subspecific identity of several rodents. Wherever possible, we have examined the pertinent specimens. Results of our examination are given below.

Our studies have been aided by a contract (NR 161-791) between the Office of Naval Research, Department of the Navy, and the University of Kansas. Also, a grant from the Kansas University Endowment Association has permitted field work that yielded some of the specimens used for comparison. Grateful acknowledgment is made to the persons in charge of the several collections of mammals that we have consulted in order to satisfy ourselves concerning the subspecific status of specimens from many localities.

Marmota flaviventer luteola A. H. Howell

A. H. Howell (N. Amer. Fauna, 37:50, April 7, 1915) referred specimens from Bridgers Pass, Wyoming, to *Marmota flaviventer dacota*, on the basis of paler underparts because, according to the data of Howell (*op. cit.*), *M. f. dacota* and *M. f. luteola*, the contiguous subspecies, do not differ significantly in other ways. Casual comparison reveals to us no additional differences between the two. We have examined the three specimens available to Howell from Bridgers Pass (Nos. 18733/25527, 18734/25528, and 18735/25529 U. S. Biol. Surv. Coll.) and find the tone of the underparts to be darker (more nearly russet) than in typical *luteola*. The tone, however, varies considerably, both individually and geographically, in *luteola* and it is possible to match almost exactly the ventral coloration of the specimens from Bridgers Pass with that of specimens from within the geographic range of *luteola;* Nos. 160509, from Bear Creek, 8 miles west of Eagle Peak, Wyoming, 18875 and 18731/25535, from the Laramie Mts., Wyoming, and No. 203744 from Sulphur Springs, Grand County, Colorado, all in the United States Biological

Surveys Collection, are examples to the point. Being influenced by the geography of the region, we therefore consider the three specimens from Bridgers Pass best referred to the subspecies *Marmota flaviventer luteola.*

Spermophilus variegatus grammurus (Say)

A. H. Howell (N. Amer. Fauna, 56:147, May 18, 1938) accorded *Citellus* [= *Spermophilus*] *variegatus utah* Merriam a geographic range that included the Kaibab Plateau of Arizona. Durrant (Univ. Kansas Publ. Mus. Nat. Hist., 6:119, August 10, 1952) assigned to S. *v. grammurus* a geographic range that included southern Utah from the eastern to the western border but in doing this did not mention the rock squirrel of the Kaibab Plateau of Arizona that also might be expected to be referable to S. *v. grammurus.* Howell (*loc. cit.*) had two specimens from the Kaibab Plateau. Of these we have examined the one from Big Spring (161566 BS) and find that it lacks the darker (more tawny) head and posterior back of *C. v. utah* and agrees with *C. v. grammurus.* On this basis we refer the rock squirrel of the Kaibab Plateau to the subspecies *Spermophilus variegatus grammurus* (Say).

Tamias amoenus caurinus Merriam

This subspecies was named from the Olympic Peninsula of Washington. A. H. Howell, in his "Revision of the American chipmunks" (N. Amer. Fauna, 52:77, and fig. 5, 1929) regarded the geographic range of *Eutamias* [= *Tamias*] *amoenus caurinus* as the mountains of the Olympic Peninsula and most of Mt. Rainier. The geographic range of the *amoenus* chipmunk on Mt. Rainier almost certainly is continuous with that of *T. a. ludibundus* in the Cascade Mountains of which Mt. Rainier is a westward-projecting arm. There is no contact between the chipmunks of Mt. Rainier and those of the Olympic Peninsula; those on the Peninsula are geographically isolated from all others of the species and are separated from those on Mt. Rainier by approximately eighty miles of low-lying country, which is uninhabited by chipmunks of the species *Tamias amoenus.* Therefore, Howell's (*loc. cit.*) assignment of most of the chipmunks on Mt. Rainier to *caurinus* is open to question and Dalquest, in the "Mammals of Washington" (Univ. Kansas Publ. Mus. Nat. Hist., vol. 2, 1948) evidently thought that Howell had incorrectly identified them. On page 256 Dalquest (*op. cit.*) defined the geographic range of *T. a. caurinus* as restricted to the Olympic Peninsula and showed (fig. 81) Mt. Rainier to be in the geographic range of

T. a. ludibundus. We would accept Dalquest's (*op. cit.*) arrangement without question and also would follow it because it is the more recent one were it not for the fact that Dalquest gives no reason for his changes. To allow us to decide the matter we have compared the pertinent materials ourselves. Catalogue numbers below are of the United States National Museum, Biological Surveys Collection, and each specimen mentioned by catalogue number is an adult female which shows much wear on the fourth upper premolar.

Of *T. a. caurinus,* Nos. 241902 and 241903 are from 2 mi. SW of Mount Angeles; No. 241911 is from "near" head of Dosewallips River, 6000 ft., and No. 241915 is from Canyon Creek, 3 mi. S Soleduc River, 3550 ft. Of *T. a. ludibundus,* Nos. 234776 and 235018 are from Barron, 5000 ft., and No. 230685 is from Suiattle River, 6500 ft. Of specimens in question, from Mount Rainier, No. 90635 is from 6500 ft., west slope; No. 232729 is from 4900 ft., Reflection Lakes, and No. 233114 is from 5300 ft., Indian Henrys.

In comparison with *T. a. ludibundus, T. a. caurinus* is grayer on most, or all, parts of the pelage, has less ochraceous on the sides, and the dark stripes on the sides of the head are narrower and less reddish (more grayish). The skull of *caurinus* is larger in certain measurements, as shown below:

Catalogue number	Occipitonasal length	Zygomatic breadth	Cranial breadth	Length of nasals	Greatest width across upper molars
			T. a. ludibundus		
234776	34.0	19.3	15.6	10.2	...
235018	34.1	....	....	10.4	8.0
230685	33.5	18.8	15.5	10.4	7.9
			Mt. Rainier		
90635	34.5	19.2	16.3	10.8	8.3
232729	....	18.5	15.3	....	8.2
233114	34.2	18.6	15.7	10.8	8.0
			T. a. caurinus		
241911	34.5	19.7	16.2	11.3	8.3
241915	34.2	....	....	10.3	8.3
241902	35.2	....	16.8	11.1	8.1
241903	34.7	....	16.0	10.8	8.4

Howell (*op. cit.:* 75) referred three specimens from Glacier Basin, on the northeastern part of Mount Rainier, to *T. a. ludibundus* as he

did also one specimen (*loc. cit.*) from Reflection Lakes, on the southern flank of the mountain. Our comparisons indicate the correctness of Howell's identification of the specimens from Glacier Basin; they more closely resemble *ludibundus* than *caurinus*. The specimen from Reflection Lakes, however, is only one of five or six from the same place; the others were lumped by him among the 49 that he recorded from Mount Rainier under the name *caurinus*. The series from Reflection Lakes, so far as we can detect, is not unusually variable and the differences that are apparent are within the normal range of variation ascribable to season, age, and individualism. Also, the series from Reflection Lakes, to us, is not appreciably different from the other series, representing the following places on Mount Rainier: Indian Henrys, 5300 ft.; W slope Mt. Rainier, 6600 ft.; St. Andrews Park, 5500 ft.; Spray Park, 5500 ft.; Paradise Park; Muddy Fork of Cowlitz River; Sunset Park, 5000 ft.; ridge between St. Andrews Park and South Puyallup River, 6000 ft.; and Owyhigh Lakes, 5350 ft.

Collectively, or individually, where there are as many as six specimens from a place, the material from Mt. Rainier (Glacier Basin excepted) is intermediate in color between *T. a. ludibundus* and *T. a. caurinus* and no more closely resembles one subspecies than the other. As may be seen from the cranial measurements recorded above, specimens from Mt. Rainier, although intermediate between the two subspecies just mentioned, resemble *ludibundus* in lesser zygomatic breadth and lesser cranial breadth (and, it may be added, in lesser dorsolateral inflation of the braincase), but resemble *caurinus* in longer skull (occipitonasal length), longer nasals and greater breadth across the rows of upper molariform teeth.

In summary: The animals from Mount Rainier, in features of taxonomic import, are almost exactly intermediate between *T. a. caurinus* and *T. a. ludibundus*. Being influenced by considerations of geographic adjacency, we refer the animals on Mount Rainier to *Tamias amoenus ludibundus* (Hollister).

Dalquest's (*op. cit.*: 85) explanation of the probable origin of *Tamias amoenus caurinus* is pertinent here. He writes: "The chipmunks of the Olympic Mountains [*caurinus*] probably reached their present range from the Cascades. Their probable path of emigration was westward from Mt. Rainier, along the glacial outwash train of Nisqualli Glacier, to the moraine and outwash apron of the Vashon Glacier and thence to the Olympics. So similar are the chipmunks of Mt. Rainier and the Olympic Mountains that Howell (1929) included Mt. Rainier in the range of *caurinus*."

Tamias townsendii cooperi Baird

Some uncertainty exists concerning the subspecific identity of the Townsend Chipmunk in southern Washington because Dalquest (Univ. Kansas Publ. Mus. Nat. Hist., 2:262, April 9, 1948) identified as *Tamias townsendii cooperi* specimens that he examined from Yocolt, a place well within the geographic range of *T. t. townsendii* as defined by A. H. Howell (N. Amer. Fauna, 52: fig. 7, p. 107, November 30, 1929). Dalquest (*op. cit.*) referred other specimens, that he did not examine, from Mt. St. Helens (90654, 231112 and 231114 BS) to *T. t. cooperi* although Howell (N. Amer. Fauna, 52:109, November 20, 1929) had previously identified them as *E. t. townsendii.* By implication, and on his map, Dalquest (*op. cit.*, fig. 83, p. 261) assigned to *T. t. cooperi* still other specimens, that he had not examined, from: Government Springs, 15 mi. N Carson (230514, 230515, 230559, 230560, and 230563 BS); Stevenson (230513 and 230517 BS); and Skamania (230518 BS). Earlier, Howell (*op. cit.*) had listed the specimens from the three mentioned localities as *Eutamias townsendii townsendii.*

Our examination of specimens in the Museum of Vertebrate Zoology from 1½ mi. W Yocolt (94238 and 94239 MVZ) and from 3½ mi. E and 5 mi. N Yocolt (94240-94244 MVZ) reveals that the "average" of the coloration is nearer to that of the paler *T. t. cooperi* than to that of the darker *T. t. townsendii* and indicates why Dalquest, we think correctly, identified specimens from Yocolt as *T. t. cooperi.* We have examined also the specimens in the Biological Surveys Collection of the United States National Museum (catalogue numbers given above) and have compared them with specimens (comparable in age and seasonal condition of pelage) of *T. t. townsendii* (notably a series from Lake Quinalt, Washington) and of *T. t. cooperi* (including specimens from Bumping Lake and Blewett Pass, Washington). In color, the specimens from Mt. St. Helens are almost exactly intermediate between *T. t. cooperi* and *T. t. townsendii.* We choose to use for them the name *T. t. townsendii* as did Howell (*op. cit.*:109). The specimens from 15 mi. N Carson, those from Stevenson and the one from Skamania agree in nearly all features of color with the relatively paler *T. t. cooperi,* as Dalquest (*op. cit.*) thought they would, and we, accordingly, use for them the name *Tamias townsendii cooperi.*

In view of the findings resulting from our study of the above mentioned specimens of the Townsend Chipmunk in Washington, it seemed worthwhile to examine the material of the same species from Hood River, Oregon. Howell (*op. cit.*:109) listed one speci-

men from there as *E. t. townsendii*, but (*op. cit.:* fig. 7, p. 107) mapped the locality as within the geographic range of *E. t. cooperi.* The specimen (89061 BS) is a juvenile having external measurements of only 175, 80 and 31. Although the color is intermediate between that of the two subspecies concerned, greater resemblance is shown to *T. t. townsendii.* We have not examined any other specimen of the species *Tamias townsendii* so young as No. 89061, but suspect that older specimens from the same place would be paler by a slight degree. This suspicion, and more especially the light color of an older specimen from nearby White Salmon, Washington, and the light color of two older specimens from Parkdale, Oregon, which seem to us to be referable to *T. t. cooperi,* influence us to refer the specimen from Hood River to *Tamias townsendii cooperi* Baird.

Tamias townsendii townsendii Bachman

A. H. Howell (N. Amer. Fauna, 52:111, November 30, 1929) referred specimens of the Townsend Chipmunk from the lower elevations on the Olympic Peninsula to *Eutamias townsendii townsendii* but referred specimens from the central mountains on that peninsula to *Eutamias townsendii cooperi.* The subspecies *T. t. cooperi* thus is represented as having a geographic range of two separate parts: (1) The Cascade Mountains from southern British Columbia into southern Oregon, and (2) the area of the Olympic Mountains, the latter area being entirely surrounded by the geographic range of *T. t. townsendii.* Dalquest (Univ. Kansas Publ. Mus. Nat. Hist., 2:261 and 262, April 9, 1948) employed Howell's arrangement.

We have examined the specimens, in the Biological Surveys Collection of the United States National Museum, from the Olympic Peninsula and fail to find significant differences in external measurements or in size or shape of skulls between specimens from the mountains (alleged *T. t. cooperi*) and those from other parts of the Peninsula (assigned to *T. t. townsendii*). Nevertheless, the specimens from the higher parts of the Olympic Mountains resemble *T. t. cooperi* in being less ochraceous than are specimens of *T. t. townsendii* from elsewhere on the Olympic Peninsula, and in this one respect, in series, they more closely resemble *T. t. cooperi.* Even so, the upper parts of the specimens from the mountains are darker than in *T. t. cooperi* of the Cascades. In dark color of the superciliary stripe the specimens in question are referable to *T. t. townsendii.* The over-all gray tone, resembling that of *T. t. cooperi,* upon close inspection is found to be in considerable degree the result of wear, and the difference in grayness from *T. t. townsendii,*

when specimens in comparable pelage are compared, is slight. This tendency to lighter color in specimens from higher elevations is seen in other places in Washington within the geographic range of *Tamias townsendii*. We feel, therefore, that the mentioned resemblance in color between specimens from the Olympic Mountains and those of *T. t. cooperi* from the Cascade Mountains is not significant taxonomically. To us, all of the animals of the species *Tamias townsendii* from the Olympic Peninsula seem best referred to the subspecies *Tamias townsendii townsendii* Bachman.

Tamias striatus ohionensis Bole and Moulthrop

A. H. Howell (Jour. Mamm., 13:166, May 14, 1932) referred a specimen (252979 USNM) from Athens, Ohio, to *Tamias striatus fisheri*. Subsequently, Bole and Moulthrop (Sci. Publs. Cleveland Mus. Nat. Hist., 5:83-181, September 11, 1942) named *Tamias striatus ohionensis* and *Tamias striatus rufescens*, both of which occur in Ohio. They (*op. cit.* :137) also excluded *T. s. fisheri* from the state list of mammals of Ohio. The locality of Athens lies between the ranges of *T. s. ohionensis* and *T. s. rufescens*, as outlined by referred specimens, and thus the identity of the specimen from that place was left in doubt. We have examined the specimen and among named kinds find that it most closely resembles *T. s. ohionensis* in its less widely spreading zygomata, slender incisors and dull-colored pelage. We prefer the specimen to *T. s. ohionensis*.

The subspecific identity of specimen No. 174762 USNM, a skin only, from Nobleville, Hamilton Co., Indiana, assigned by Howell (N. Amer. Fauna, 52:21, November 30, 1929) to *T. s. griseus* and by Lyon (Amer. Mid. Nat., 17(1):191, January, 1936) to *T. s. fisheri*, was left in doubt by Bole and Moulthrop's (*op. cit.*) assignment of specimens to *T. s. ohionensis*. Although the specimen lacks a skull and tail, on the basis of its dull-colored pelage and dark brown (anteriorly) median dorsal stripe, we identify No. 174762 as *T. s. ohionensis*. For the same reason, specimen No. 125445 USNM, from Bascom, Indiana, referred by Howell (*op. cit.*:16) to *T. s. striatus*, and by Lyon (*op. cit.*:191) to *T. s. fisheri*, required reexamination. The specimen appears to be an intergrade between *T. s. striatus* and *T. s. ohionensis;* it is probably best referred to the latter subspecies which it resembles in having short nasals. In color it is intermediate, but it does not possess the narrowly spreading zygomata of *T. s. ohionensis* and, in this respect, more nearly approaches *T. s. striatus*.

Specimen No. 13815 USNM, an alcoholic, from Wheatland, Knox

Co., Indiana, was assigned by Howell (*op. cit.*, 1929:21) to *T. s. griseus* and by Lyon (*loc. cit.*) to *T. s. fisheri*. Although the specimen is much faded and cannot be identified with certainty, we assign it to *T. s. ohionensis*. Allowing for fading, it seems to resemble *ohionensis* more in the lighter color of the anterior part of the median dorsal stripe, than it does either *griseus* or *fisheri*. We are also influenced in making this allocation by Bole and Moulthrop's (*op. cit.* :137) finding intergradation between *T. s. ohionesis* and *T. s. striatus* in a specimen obtained at New Harmony, Posey Co., Indiana.

Howell (Jour. Mamm., 13:166, August 9, 1932) referred two specimens from Boone County, Indiana, to *T. s. fisheri*. We have examined a specimen (5675 AMNH) from that place and think it is one of the two seen by Howell. The specimen is a poorly made skin in worn winter pelage with the skull inside. Because it differs from *T. s. fisheri* and agrees with *T. s. ohionensis* in the color of both upper parts and underparts (comparisons made with material of comparable stage of molt), we assign it to the latter subspecies. Howell (*loc. cit.*) referred specimens from Overton (57394), Wooster (57398, 57399, and 57442), and Loudonville (57391-57393), all from Ohio, in the Museum of Zoology of the University of Michigan, to *Tamias striatus fisheri*. We have examined these specimens and find them to be readily separable from *T. s. rufescens* on the basis of darker coloration. The affinities of the specimens in question are with *T. s. fisheri* and *T. s. ohionensis*. As a standard for comparison we have used specimens in the Museum of Zoology, University of Michigan, in comparable pelage of *T. s. ohionensis* from Dearborn County, Indiana, taken in August and specimens of *T. s. fisheri* from "near" summit Butt Mtn. and Little Meadows, both places in Giles County, Virginia, as well as two specimens from Allair, Monmouth County, New Jersey. On the basis of buffy (instead of white) edging of the tail, buffy (not white) light dorsal stripes, and buffy (not black) anterior third of the median dark stripe, the specimens from Overton, Wooster, and Loudonville are referred to *Tamias striatus ohionensis*.

Tamias striatus pipilans Lowery

A. H. Howell (N. Amer. Fauna, 29:16, November 30, 1929) recorded six specimens of *Tamias striatus striatus* from Greensboro, Alabama. Subsequently, Lowery (Occas. Papers Mus. Zool., Louisiana State Univ., 13:235, November 22, 1943) named *T. s. pipilans* and assigned to it specimens from northeastern Alabama. Lowery did not, however, mention the specimens from Greensboro and,

thus, their subspecific identity was placed in doubt. We have examined five of the six specimens mentioned by Howell (*loc. cit.*) (57034-57036, 57588, and 77037 BS) and because of their brilliant color and large size, refer them to *Tamias striatus pipilans* Lowery.

Tamias striatus rufescens Bole and Moulthrop

A. H. Howell (Jour. Mamm., 13:166, August 9, 1932) also referred a specimen (13154), from La Porte, Indiana, in the Chicago Nat. History Museum to *T. s. fisheri.* We find the specimen to be distinguishable from *T. s. fisheri* in darker, richer pelage, brown instead of blackish anterior third of the median dorsal stripe, more buffy light dorsal stripes, and more heavily constructed skull. The specimen most closely resembles *T. s. rufescens* in having, as compared to *T. s. ohionensis,* brighter, more rufescent color, wider incisors, proportionately narrower interorbital region, and more widely spreading zygomatic arches. We refer it to that subspecies.

Sciurus carolinensis pennsylvanicus Ord

When J. A. Allen considered what name to apply to the gray squirrel of northeastern United States and adjacent parts of Canada, (Monogr. N. Amer. Rodentia, p. 709, 1877) he selected the name *leucotis* of Gapper (Zool. Jour., 5:206, 1830) as applicable. Allen rejected Ord's (Guthrie's Geog., 2nd Amer. Ed., Zool. App., 2:292, 1815) earlier name, *Sciurus Pennsylvanica,* because (*loc. cit.*) "it was given to specimens from the Middle Atlantic States, and hence from a locality bordering upon the habitat of the southern form, and consequently the name is not strictly applicable to the northern type as developed in the Northern and Northeastern States and the Canadas." It must be recalled that Allen had not at that time seen a copy of Ord's exceedingly rare work and was basing his comments on Baird's statements on Ord's treatment of the squirrels.

Subsequently, Rhoads obtained a copy of the second edition of Guthrie's Geography and had Ord's zoological appendix thereto reprinted. The reprinted version (now known generally as Ord's Zoology by Rhoads, 1894) contains (Appendix, p. 19) Rhoads' review of the *pennsylvanicus vs. leucotis* controversy. Rhoads concluded that *pennsylvanicus* must apply because it has priority and is available. The habitat was given by Ord as "those parts of Pennsylvania which lie to the westward of the Allegany ridge," not the "Middle Atlantic States" as Allen thought.

Notwithstanding Rhoads' comments, Bangs (Proc. Biol. Soc. Washington, 10:156, December 28, 1896), in his "Review of the

Squirrels of Eastern North America," employed *leucotis* Gapper and rejected Ord's name because it "is a *nomen nudum*" and of uncertain application. There seems to have been no attempt subsequently to review the pertinent names.

We are of the opinion that Rhoads' (*loc. cit.*) analysis and conclusions are correct and as cogent today as then. We do not agree with Bangs that *pennsylvanicus* is a *nomen nudum* for the following reasons. The name was based on melanistic individuals and could conceivably be applied to three species of squirrels, the red squirrel, the fox squirrel, and the gray squirrel. Melanistic red squirrels, *Tamiasciurus hudsonicus,* are everywhere rare and in any case appear as individuals and not populations. Ord (*loc. cit.*) reported that his *Sciurus Pennsylvanica* was *abundant.* Ord, we think, was not referring to the fox squirrel, *Sciurus niger,* because he wrote that *S. Pennsylvanica* "has always been confounded with . . . [*Sciurus niger*], but it is a different species," and (*loc. cit.*) described *S. niger* as a "Large Black Squirrel" and *Sciurus Pennsylvanica* as a "Small Black Squirrel." Therefore, *pennsylvanicus* Ord can refer only to *Sciurus carolinensis.* Further, melanistic gray squirrels then, as now, were common in western Pennsylvania and exceedingly rare in eastern Pennsylvania. Additionally, Ord described his animal, although admittedly inadequately (small, black, not *S. niger*). The name *Sciurus Pennsylvanica* Ord is clearly not a *nomen nudum* and must replace *leucotis* Gapper.

Allen's (*loc. cit.*) argument that the specimens were not representative of "*leucotis*" because they were from the Middle Atlantic States is based on an initial misunderstanding of the locality. Further, whether or not "topotypes" are representative of a subspecies has no bearing on the availability of the name appended to them. The name and synonomy of the northern gray squirrel are as follows:

Sciurus carolinensis pennsylvanicus Ord

1815. *Sciurus Pennsylvanica* Ord, Guthrie's Geog., 2nd Amer. Ed., 2:292. Type locality, western Pennsylvania.

1894. *Sciurus carolinensis pennsylvanicus,* Rhoads, Appendix of reprint of Ord (*supra*), p. 19.

1792. *Sciurus cinereus* Schreber, Säuget., 4:766. Type locality, eastern United States, probably New York State. (*Nec Sciurus cinereus* Linnaeus.)

1830. *Sciurus leucotis* Gapper, Zool. Jour., 5:206. Type locality, region between York and Lake Simcoe, Canada.

1849. *Sciurus migratorius* Audubon and Bachman, Quad. N. Amer., 1:265 (based on S. *leucotis* Gapper).

1877. *Sciurus carolinensis* var. *leucotis,* J. A. Allen, Monogr. N. Amer. Rodentia, Sciuridae, p. 700 (*et auct.*).

Sciurus niger rufiventer Geoffroy

Two specimens (36192/48550, a young male with unworn teeth, and 36193/48551, an adult male with much worn teeth, both in the United States Biological Surveys Collection in the National Museum) were recorded by Bailey (N. Amer. Fauna, 25:75, 1905) as *Sciurus ludovicianus* from Gainesville, Texas. Bailey (*loc. cit.*) further stated that if the name *Sciurus rufiventer* Geoffroy proved usable it would apply to the specimens from Gainesville. Since the name *rufiventer* was revived there would be no question concerning the identity of these specimens had not Lowery and Davis (Occas. Papers, Mus. Zool., Louisiana State Univ., 9:172, 1942) assigned three specimens (not seen by us) to *Sciurus niger limitis* Baird from a point only thirteen miles northwesterly. Lowery and Davis (*loc. cit.*) say that their specimens are intergrades (presumably with *rufiventer*) and Bailey (*loc. cit.*) noted that his two specimens from Gainesville "are in size and color nearer to *ludovicianus* [= *rufiventer*] than to typical *limitis*." Examination of the two specimens from Gainesville convinces us that Bailey was correct and the specimens therefore are referable to *Sciurus niger rufiventer*. More in detail, the color agrees with that of *rufiventer* and differs from that of *limitis* and from that of darker specimens of *Sciurus niger ludovicianus* (in the restricted sense used by Lowery and Davis, *op. cit.*: 104). Also the size is larger than in *limitis* and as in *rufiventer* or *ludovicianus*. Selected measurements of Nos. 36192/48550 and 36193/48551 are, respectively, as follows: Total length, 505, 500; length of tail, 237, 228; length of hind foot, 72, 70; basilar length of Hensel, 48.5, 48.6; zygomatic breadth, 35.1, 36.0; length of nasals, 21.4, 22.3; alveolar length of maxillary tooth-row, 11.8, 11.1; width across posterior tongues of premaxillae, 17.5, 18.4.

Sciurus variegatoides rigidus Peters

Harris (Occas. Papers Mus. Zool., Univ. Michigan, 266:1, June 28, 1933) named *Sciurus variegatoides austini* with type locality at Las Agujas, Province of Puntarenas, Costa Rica. Later, in his revision of the species *Sciurus variegatoides*, he (Misc. Publs. Mus. Zool., Univ. Michigan, 38:19, September 7, 1937) referred specimens from Chomes, Costa Rica, to S. *v. austini* and (*op. cit.*:24) specimens from Puntarenas, Province of Puntarenas, to S. *v. rigidus*, an inland subspecies. The geographic arrangement of these referred specimens seemed to warrant a reconsideration of the material. We have examined specimens of S. *variegatoides* in the Museum of Zoology, University of Michigan, from the following localities in Costa Rica:

Puntarenas (62703-62706), Las Agujas (65118 [type of *S. v. austini*], 59847-59850), Río Las Agujas (65114-65117), Agua Caliente (66483), Zarcéro (75757-75761, 75765), Cartago (67546, 67547), and Esparta (75762-75764). The specimens listed by Harris (*op. cit.*, 1937:19) as from Chomes, in the Museum of Zoology of the University of Michigan, are not now in that museum and we have not seen them.

Harris (*op. cit.*:19) characterized *S. v. austini* as differing from *S. v. rigidus* in having brightly rufous legs (Ochraceous-Orange) in *S. v. rigidus* and a dorsal coloration resulting from a mixture of shiny black and silver (Ochraceous-Orange mixed with black in *S. v. rigidus*). We find that in the color of the legs of the paratypes of *S. v. austini* there is considerable variation ranging from bright rufous in No. 65116 to much darker and duller in No. 59849. In six of the ten specimens of the type series, the color is rufous, but in the other four the color of the legs approaches and overlaps that found in the referred specimens of *S. v. rigidus*. The color of the dorsum of *S. v. austini* is also variable. No. 59850, for example, is dark brown and closely resembles No. 75762, from Esparta, which was referred to *S. v. rigidus*. Further, some specimens referred to *S. v. rigidus* (67546 and 67547) have the bright-colored legs of *S. v. austini* and some (75759, for example) have the black-and-silver back of *austini*. We recognize differences of an average sort between the now-available specimens of the two alleged subspecies, but because of the individual variation that exists, we feel that recognition of two subspecies is not indicated. There is also some variation that is the result of wear and molt and one of us (Kelson) feels that some of the differences are explainable on this basis. Accordingly, we prefer to adopt a more conservative taxonomic arrangement than that of Harris for this group of the Costa Rican squirrels and arrange *Sciurus variegatoides austini* Harris, 1933, as a synonym of *Sciurus variegatoides rigidus* Peters, 1863.

Thomomys bottae alienus Goldman

Six specimens (21249-21253, 212706 BS) from Rice, Arizona, were referred by Goldman (Proc. Biol. Soc. Washington, 46:76, April 27, 1933) to the subspecies *Thomomys bottae mutabilis* Goldman when he proposed that name as new, but these six specimens were not mentioned by him when he later named *Thomomys bottae alienus* (Jour. Washington Acad. Sci., 28:338, July 15, 1938), to which subspecies the specimens in question might be expected to belong.

Examination of the six specimens reveals that they are intergrades between *T. b. mutabilis* and *T. b. alienus* but that the specimens more closely resemble the latter. More precisely, slightly larger size of skull, greater ventral inflation of tympanic bullae, and less depressed occipital region ally the specimens with *Thomomys bottae alienus,* and we identify them as that subspecies. The two subspecies concerned are not so distinct as are most subspecies of *Thomomys bottae.*

Thomomys bottae aphrastus Elliott

Bailey (N. Amer. Fauna, 39:58, November 15, 1915) referred three specimens from San Antonio, Baja California, to *Thomomys bottae nigricans.* These specimens have not, to our knowledge, been re-examined subsequently, although the current taxonomic treatment of the pocket gophers of Baja California by Huey (Trans. San Diego Soc. Nat. Hist., 10(4):245-268, 1 map, August 31, 1945) excludes *T. b. nigricans* from the area of San Antonio. The pertinent specimens are probably Nos. 10810-10812 in the Chicago Natural History Museum. We have examined the specimens and, using the comparative materials listed under the account of *T. b. siccovallis,* find them to be intermediate in most characters between *T. b. aphrastus* and *T. b. martirensis.* Because they more nearly resemble *T. b. aphrastus* in the weakly-spreading zygomatic arches, we refer the specimens from San Antonio to that subspecies.

Thomomys bottae jojobae Huey

When Huey (Trans. San Diego Soc. Nat. Hist., 10:256, August 31, 1945) named *Thomomys bottae jojobae* from Sangre de Cristo, Baja California, México, he made no mention of a specimen that Bailey (N. Amer. Fauna, 39:58, November 15, 1915) identified as *Thomomys bottae nigricans* from La Huerta, which place is approximately eight miles northwest of Sangre de Cristo. From a geographic standpoint, it seemed unlikely that the specimen from La Huerta would be referable to *T. b. nigricans.* Examination of the specimen (138752 BS) proves it to differ from topotypes of *T. b. nigricans* and to agree with *T. b. jojobae* in richer, more rufescent color, especially ventrally, and smaller, slenderer, more delicate skull. The specimen is therefore tentatively referred to *Thomomys bottae jojobae.* We have not, however, compared it with specimens of *Thomomys bottae juarezensis,* a subspecies the range of which lies to the east on the summit of the Sierra Juárez.

Thomomys bottae martirensis J. A. Allen

Bailey (N. Amer. Fauna, 39:58, November 15, 1915) referred pocket gophers from Piñon on the west slope of the San Pedro Mártir Mountains, Baja California, to the subspecies *Thomomys bottae nigricans.* The subspecific identity of these animals has not been reinvestigated subsequently, although the locality whence they were obtained is far removed from what is now thought to be the geographic range of *T. b. nigricans;* further, several other subspecies are known to occur in the intervening area. We have examined the available material from Piñon (13853-13855 BS) and find the specimens to agree with *Thomomys bottae martirensis* and to differ from *T. b. nigricans* in lighter color, larger, more ridged and angular skull; proportionately greater mastoidal breadth; narrower occipital shelf; more ventrally produced alveolar ramus of the maxillae; and deeply concave posterior border of the temporal root of the zygomatic arch. These specimens thus constitute the northernmost record of *T. b. martirensis* known to us.

Thomomys bottae mohavensis Grinnell

Bailey (N. Amer. Fauna, 39:73, November 15, 1915) assigned a series of 7 specimens from Lone Willow Spring, California, to the subspecies *Thomomys bottae perpes.* This locality lies at the northern edge of the Mohave Desert. Later, Grinnell (Univ. California Publ. Zool., 17:427, April 25, 1918) named the pocket gophers, from approximately the eastern half of the Mohave Desert, *Thomomys perpallidus* [= *bottae*] *mohavensis,* but failed to mention the specimens recorded by Bailey, and thus their subspecific identity is in doubt. We find that *T. b. mohavensis* differs from *T. b. perpes* in more pallid color (light yellowish as opposed to dark rufescent), larger size, larger and more angular skull, angular (as opposed to more evenly bowed) zygomatic arches, larger and deeper audital bullae, narrower interpterygoid space, and proportionately greater mastoidal breadth. In external measurements, size and angularity of skull, width of interpterygoid space and angularity of the zygomatic arch, the specimens from Lone Willow Spring seem to be intermediate between the two subspecies, but perhaps show more resemblance to *T. b. mohavensis.* Otherwise, the specimens closely resemble *T. b. mohavensis* to which they are here referred. The specimens provide a northern marginal record of occurrence for that subspecies.

Other specimens recorded as *T. b. perpes* by Bailey (*loc. cit.*) from Grapevine Ranch, California, have also not been mentioned in

later publications although, from a geographic standpoint, they might be better referred to either *Thomomys bottae pascalis* or *T. b. mohavensis.* Comparison of specimens of *T. b. mohavensis* and *T. b. pascalis* from various localities show *T. b. pascalis* to be larger (including the skull), darker, and to possess a more nearly vertical occipital plane, wider-spread but less angular zygomatic arches, less inflated tympanic bullae, wider braincase (which consequently appears to be less inflated), proportionately longer and slenderer rostrum, and broader nasals distally. Cranially, *T. b. pascalis* differs from *T. b. perpes* in essentially the same ways, but to an event greater degree. In color, *T. b. pascalis* differs from *T. b. perpes* in being duller, less rufescent.

The series of four specimens, in the U. S. Biological Surveys Collection, from Grapevine Ranch clearly are not referable to *T. b. perpes.* They do, however, agree with *T. b. mohavensis* in all essential particulars except that in two of the four specimens the braincase is wider and the nasals are wider distally. This width is evidence of intergradation with *T. b. pascalis.* Seemingly, then, they are best referred to *Thomomys bottae mohavensis.*

Thomomys bottae muralis Goldman

When Goldman (Jour. Washington Acad. Sci., 26(3):112, March 15, 1936) described and named this pocket gopher from Arizona, he arranged it as a full species and stated that there is no evidence of intergradation with other named kinds. We have examined the holotype and three topotypes (202579-202582 BS) and compared them with specimens of other kinds of pocket gophers occurring in northern and central Arizona. The *muralis* gopher is a depauperate form clearly belonging to the *bottae* group. The characters which Goldman (*loc. cit.*) set forth as distinguishing *muralis* from other named kinds are readily apparent and, like Goldman, we see no evidence of intergradation. Nevertheless, the characters which serve to identify the race are, in a general way, those commonly found in populations of depauperate individuals of *Thomomys bottae* and *T. talpoides.* The small size, delicate structure, well-inflated braincase, short premaxillary tongues, and strongly recurved upper incisors, often appear in populations existing in inhospitable areas of shallow, unstable soils. For this reason we feel that the relationships of this population are best shown by arranging *muralis* as a subspecies of *Thomomys bottae;* the name should stand as *Thomomys bottae muralis* Goldman.

As far as known, *T. b. muralis* is completely isolated from other

populations of pocket gophers by uninhabitable eroding cliffs. The animals have been found only on isolated terraces in the lower end of Prospect Valley (itself a lateral pocket) within the Grand Canyon of the Colorado River, Hualpai Indian Reservation, Arizona. Consequently it is unlikely that intergradation with other populations could exist at the present time.

In short, in arranging *muralis* as a subspecies of *Thomomys bottae,* we are influenced, not by the demonstration of intergradation, but by the degree of morphological differentiation of the population and the probable reasons therefor.

Thomomys bottae mutabilis Goldman

Goldman (Jour. Washington Acad. Sci., 28:342, July 15, 1938) named the subspecies *Thomomys bottae pinalensis* on the basis of only one specimen, an immature female (245709 BS) from Oak Flat, five miles east of Superior, Pinal Mountains, Arizona. Examination shows it to be indistinguishable in characters of taxonomic importance (coloration, external measurements, shape of skull and size of skull) from specimens of *T. b. mutabilis* of comparable sex and age. No. 245709 is well within the limits of individual variation of *T. b. mutabilis* as is shown by the several specimens (all in the U. S. Biological Surveys Collection) as follow: Nos. 214118, 214670 (topotypes from Camp Verde, Arizona), 212707 (Chiricahua Ranch, 20 mi. E Calva), 208635 (H-bar Ranch, 20 mi. S Payson), and 215762 (Turkey Creek). Therefore, the name *Thomomys bottae pinalensis* is here arranged as a synonym of the earlier name, *Thomomys bottae mutabilis* Goldman (Proc. Biol. Soc. Washington, 46:75, April 27, 1933), the type locality of which is Camp Verde, Yavapai County, Arizona.

Thomomys bottae patulus Goldman

When Goldman (Jour. Washington Acad. Sci., 26:113, March 15, 1936) named the subspecies *Thomomys bottae desitus,* he assigned to it (*op. cit.*:114) 10 specimens obtained at Wickenburg, Maricopa County, Arizona. He did not mention specimens from Wickenburg when he subsequently named the subspecies *Thomomys bottae patulus* (Jour. Washington Acad. Sci., 28:341, July 15, 1938) and stated that *T. b. patulus* was known only from the type locality in the "bottomland along [the] Hassayampa River, two miles below Wickenburg." Examination in 1950 of specimens referable to *T. b. patulus* in the U. S. Biological Surveys Collection shows all of them, including the holotype, to be labeled "Wickenburg." The 10 speci-

mens from Wickenburg reported by Goldman in 1936 as *T. b. desitus* were included by him among the 16 (actually 17, one being a skull only) upon which he based his description of *T. b. patulus* in 1938. Examination of the field catalogues of 3 of the 4 collectors who obtained the specimens discloses that only the 7 specimens obtained last were recorded as occurring in the Hassayampa River bottoms; the first 10 were recorded only as from "Wickenburg." Briefly, only one subspecies, *T. b. patulus,* is present in the area, and Goldman in 1938 seems to have thought that the two localities were actually the same, and that "2 miles below Wickenburg" was the more precise designation.

Thomomys bottae providentialis Grinnell

We have examined a specimen, No. 26120/33526, from 12-Mile Spring, California, in the U. S. Biological Surveys Collection, which Bailey (N. Amer. Fauna, 39:73, November 15, 1945) referred to the subspecies *Thomomys perpallidus* [= *aureus*] *perpes.* We find the specimen to be referable to the later named *Thomomys bottae providentialis* on the basis of smaller ear, more massive, more ridged and angular skull, greater interorbital breadth, deeper and thicker rostrum, less globular bullae, and U-shaped rather than V-shaped interpterygoid space. Therefore, 12-Mile Spring is the northernmost locality of occurrence of the subspecies *T. b. providentialis.*

Thomomys bottae sanctidiegi Huey

In his discussion of the pocket gophers of Baja California, Huey (Trans. San Diego Soc. Nat. Hist., 10:245-268, map, August 31, 1945) made no mention of specimens from Ensenada, Baja California, recorded by Bailey (N. Amer. Fauna, 39:58, November 15, 1915) as *Thomomys bottae nigricans.* We have examined the specimens from Ensenada available to Bailey in the U. S. Biological Surveys Collection, Nos. 137724, 139890, and 139891, subadult, immature, and adult, respectively. As compared with *Thomomys bottae sanctidiegi* from the mouth of the Tiajuana River (No. 126028) and *T. b. nigricans* (topotypes), the one adult specimen from Ensenada agrees with *T. b. sanctidiegi* and differs from *T. b. nigricans* in lighter color, larger and more angular skull, and more inflated braincase. The specimens from Ensenada differ from the adjacent subspecies to the south, *Thomomys bottae proximarinus* [to judge from Huey's (*op. cit.*) characterization of that subspecies] in lighter color, and larger, more robust skull. Accordingly, the specimens from Ensenada are referred to *Thomomys bottae sanctidiegi.*

Thomomys bottae siccovallis Huey

Bailey (N. Amer. Fauna, 39:58, November 15, 1915) listed a specimen from Mattomi, Baja California, as *Thomomys bottae nigricans.* When Huey (Trans. San Diego Soc. Nat. Hist., 10:259, August 31, 1945) revived the name *Thomomys* [*bottae*] *aphrastus* Elliot, and named (*op. cit.*:258) *Thomomys bottae siccovallis* he made no mention of the specimen, from Mattomi, which, on geographic grounds, would be expected to be *T. b. aphrastus, T. b. martirensis* J. A. Allen, or *T. b. siccovallis.* We have examined an adult male (10832 CNHM), probably the specimen seen by Bailey (*loc. cit.*), from Mattomi, and have compared No. 10832 with six topotypes (10813-10816, 10819 and 10820 CNHM) of *T. b. martirensis,* the type and one topotype (10798 CNHM) of *T. b. aphrastus* and with the original description of *T. b. siccovallis.* The specimen from Mattomi seems to be unique in the large size of the tympanic bullae. The specimen in question differs from *T. b. martirensis* also in shorter and wider skull, shorter and wider rostrum, and longer and wider molariform teeth. In these features resemblance is shown to the holotype of *T. b. aphrastus* and even greater resemblance is shown to *T. b. siccovallis* to which the specimen from Mattomi is referred.

Thomomys monticola mazama Merriam

This subspecies of the Cascades of Oregon and *Thomomys monticola nasicus* of the territory immediately to the east of the Cascades, in the same state, were originally described (Merriam, Proc. Biol. Soc. Washington, 11:214 and 216, respectively, July 15, 1897) and redescribed (Bailey, N. Amer. Fauna, 39:123 and 125, respectively, November 15, 1915) as distinguished from each other by paler color, smaller tympanic bullae and longer nasals in *T. m. nasicus.* The holotypes do differ in these respects. The assigned (by Bailey, *loc. cit.*) specimens indicate that the opposite condition obtains with respect to the size of bullae; that is to say, the bullae are smaller in *T. m. mazama.* In these referred specimens from Oregon the nasals are actually and relatively longer in *T. m. nasicus,* which averages paler (less black and more red). Certain specimens of the two subspecies that are comparable as to sex, age and season, are indistinguishable in color.

This is the background against which Bailey (*op. cit.*:125), contrary to his statement of geographic ranges (*op. cit.*:123, 125) and map (*op. cit.*:fig. 5, p. 23), assigned, in his list of specimens ex-

amined, two specimens (♂ ad. 79817 and ♀ ad. 79818 BS) from Pengra, west of the Cascades, to the subspecies *T. m. nasicus.* In the specimens from Pengra the bullae are angular as in referred specimens of *nasicus* (unlike those of the holotype), the rostra are intermediate in length between those of the two subspecies concerned, and the color is light as in *T. m. nasicus* but can be matched by that of certain specimens of *T. m. mazama,* for example by that of No. 79821 BS from Diamond Lake, Oregon. Consequently, on morphological grounds, the two specimens from Pengra can be assigned to *T. m. mazama* almost as well as to *T. m. nasicus.* Having regard for the geographic relations, we assign them to *T. m. mazama.*

In making this tentative identification we are aware that the acquisition of more nearly adequate material from Oregon, and critical study of such material, may bring a subspecific arrangement of the populations of *Thomomys monticola* different from the current one.

Thomomys talpoides bullatus Bailey

Bailey (N. Amer. Fauna, 39:101, November 15, 1915) identified as *Thomomys talpoides clusius* two specimens (66465 and 66523 BS) from Pass (= Parkman) and one specimen (66464 BS) from Dayton, in Wyoming. We have examined these specimens and find that they lack the broad braincase and narrow nasals of *clusius* and in these and in other features the three specimens resemble *T. t. caryi* and *T. t. bullatus* more than they resemble any other named kinds. Although structurally, and in color, intermediate between the two subspecies named immediately above, the specimens show greater resemblance (large size and narrow braincase) to the latter and are referred by us to *Thomomys talpoides bullatus.*

Thomomys talpoides clusius Coues

Bailey (N. Amer. Fauna, 39:102, November 15, 1915) identified as *Thomomys talpoides bullatus* an adult male (147347 BS) from the J. K. Ranch, 5900 ft., on Meadow Creek, Wind River, Wyoming [= Wind River of Bailey, *loc. cit.*] and a young female (168666 BS) from Sage Creek, 8 mi. NW Fort Washakie, Wyoming. The rosaceous tone of these pale individuals is more as in some populations of *T. t. ocius* and *T. t. clusius* to the southward. Also, the skull of the male, although large, is distinctly narrower than in *T. t. bullatus* and we think shows the influence of the *T. t. tenellus* stock. All features considered, we refer the specimens to *T. t. clusius.*

Thomomys talpoides glacialis Dalquest and Scheffer

Vernon Bailey (N. Amer. Fauna, 39:119, November 15, 1915) listed 19 specimens from Roy, Washington, as *Thomomys douglasi yelmensis* Merriam. Our examination of 26 specimens (205039-205051, 205072-205077, and 206545-206551 BS) labeled as "Roy," and presumably including those listed by Bailey (*loc. cit.*), leads us to identify all 26 as *Thomomys talpoides glacialis* on the basis of widely spreading zygomatic arches and decidedly ochraceous hue of underparts.

Geomys bursarius jugossicularis Hooper

Seven skins with skulls (35104/47369-35110/47375 BS) from Las Animas, Colorado, probably formed the basis for Cary's (N. Amer. Fauna, 33:129, August 17, 1911) record of *Geomys lutescens* from that locality. Comparison of the material reveals that the animals are referable instead to the later named subspecies, *Geomys lutescens jugossicularis* Hooper (Occas. Papers Mus. Zool., Univ. Michigan, 420:1, June 28, 1940), on the basis of (1) more reddish color, (2) deeper zygomatic plate, (3) shorter jugal as expressed as a percentage of the length of the part of the zygomatic arch anterior to the jugal, and (4) larger area of inner face of jugal exposed when skull is viewed from directly above. Possibly it is noteworthy that the specimens from Las Animas are larger than Hooper's holotype and one topotype; this larger size is indicative of intergradation with *G. b. lutescens* as represented by the specimens examined by us from Pueblo.

Our examination of an adult female, No. 128242 BS and a juvenal female, No. 128243 BS, from 15 mi. E Texline, Texas, recorded by Bailey (N. Amer. Fauna, 25:132, October 24, 1905) under the name *Geomys lutescens* reveals that the specimens are referable to *Geomys bursarius jugossicularis* instead of to *Geomys bursarius major* on the basis of (1) mastoid part of tympanic bulla more inflated posteriorly, (2) narrowness of frontals between posterior tongues of the premaxillae and, (3) lighter color.

Liomys irroratus irroratus Gray

When Hooper and Handley (Occas. Papers Mus. Zool., Univ. Michigan, 514:1-34, October 29, 1948) published a revised map (*op. cit.*:3) showing the geographic distribution of the subspecies of *Liomys irroratus* they did not mention a specimen from Agusinapa, Guerrero, which inferentially from their map would be *L. i. irroratus* although it previously had been recorded as *L. i. torridus*

by Goldman (N. Amer. Fauna, 34:55, September 7, 1911). We have examined the specimen (70228 BS), which retains the upper deciduous premolar. Its long foot (32 mm.) and broad cranium (13 mm.) are the bases for identifying the specimen as *Liomys irroratus irroratus* instead of *L. i. minor,* which is smaller.

Liomys irroratus minor Merriam

When Hooper and Handley (Occas. Papers Mus. Zool., Univ. Michigan, 514:1-34, October 29, 1948) published a revised map (*op. cit.*:3) showing the geographic distribution of the subspecies of *Liomys irroratus* they did not mention five specimens from Tlapa, Guerrero, which inferentially from their map would be *L. i. irroratus* although these specimens previously had been recorded as *L. i. torridus* by Goldman (N. Amer. Fauna, 34:55, September 7, 1911). We have examined the five specimens (70221-70225 BS), three of which retain the upper deciduous premolars and two of which have the upper fourth premolar unworn. The short, wide rostrum is unlike the long slender rostrum of topotypes of *L. i. torridus* of comparable age, and agrees with the condition in topotypes of *L. i. minor* of comparable age. It is on this basis of wider rostrum that we refer the five specimens from Tlapa to *Liomys i. minor* which Hooper and Handley (*op. cit.*:13) described as differing from the geographically adjacent *L. i. irroratus* in "short and strongly tapered rostrum." We would add that we have not independently verified this difference between *L. i. minor* and *L. i. irroratus* for want of specimens of *L. i. irroratus* comparable in age to the five individuals from Tlapa.

The map of Hooper and Handley (*loc. cit.*) inferentially excludes Tlalixtaquilla, Guerrero, from the geographic range of *L. i. minor* (and places Tlalixtaquilla within the range of *L. i. irroratus*) although Goldman (*op. cit.*:56) previously had identified specimens from this place as *L. i. minor.* Our examination of the two immature specimens (70227 and 70230 BS) from Tlalixtaquilla reveals that they closely resemble the holotype of *L. i. minor* and leads to the conclusion that they are *Liomys irroratus minor.*

Perognathus amplus pergracilis Goldman

When Bole (Sci. Publ. Cleveland Mus. Nat. Hist., 5(2):6, December 4, 1937) named and described *Perognathus longimembris salinensis,* he listed as comparative material of *P. l. bangsi,* a specimen in the Museum of Comparative Zoology from Parker, Yuma Co., Arizona. There was some reason to doubt the identification of the

specimen since it is the only record of occurrence of the subspecies from east of the Colorado River. There is no specimen of *Perognathus longimembris* from Arizona in the Museum of Comparative Zoology. There is one specimen of pocket mouse (18213, a skin only) from 30 miles east of Parker. We think that this is the specimen seen by Bole because at one time according to the label, it had been identified as *Perognathus panamintinus* [= *longimembris*] *bangsi*. If the identification of this skin-only had been made by means of Osgood's key (N. Amer. Fauna, 18:14-15, September 20, 1900), the animal would have "keyed out" to *P. longimembris* because the total length is recorded on the label as 130. Seth B. Benson has subsequently examined the specimen. The label now bears in handwriting the name of *P. amplus pergracilis* and is followed by Benson's initials as the identifier. Although we lack adequate comparative material, we consider the specimen to be *P. amplus pergracilis* Goldman, because the skin answers well to the description of *P. a. pergracilis* and because of the name currently on the label with Benson's initials.

Perognathus longimembris panamintinus Merriam

In the current literature, Californian specimens of the little pocket mouse stand identified as *Perognathus longimembris nevadensis* from Oasis and vicinity of Benton Station (Grinnell, Univ. California Publ. Zool., 40:147, September 26, 1933). When one of us (Hall, Mammals of Nevada, p. 360, July 1, 1946) reported specimens from southwestern Nevada as *Perognathus longimembris panamintinus* he did so on the basis of study of specimens which included those from Oasis (in the California Museum of Vertebrate Zoology) that he at that time (in ms.) identified as *P. l. panamintinus*. Those specimens from Oasis have the hair on the underparts white all the way to the base as also do specimens from Morans, 5000 ft. (29583/41638 BS), in contrast to the plumbeous underparts of *P. l. nevadensis*. It is on this basis that we identify specimens from the places mentioned above as *Perognathus longimembris panamintinus*. "Vicinity of Benton Station" as given by Grinnell (*loc. cit.*) is interpreted to include Morans, Mono County.

Dipodomys agilis martirensis Huey

Elliot (Field Columb. Mus., Zool. Ser., Publ. 79, 3(12):221, August 15, 1903) referred specimens from Rosarito and Rosarito Divide, San Pedro Mártir Mts., Baja California, to *Perodipus* [= *Dipodomys*] *agilis*. According to the currently known distribution of

Dipodomys agilis in Baja California (see Huey, Trans. San Diego Soc. Nat. Hist., 11:237, April 30, 1951), the specimens seemed likely to belong to the subspecies *D. a. martirensis.* An examination of the specimens (10644, 10690-10693 CMNH from Rosarito, and 10694 from Rosarito Divide) shows that, on the basis of large ear and comparatively narrow braincase, they are in fact referable to *D. a. martirensis.* Only No. 10693, with its broader braincase, seems atypical. Comparative materials used are in the Chicago Natural History Museum as follows: *D. a. martirensis:* Baja California: San Matias Spring, 2. *D. a. simulans:* Baja California: Ensenada, 8. California: Dulzura, 1 (topotype); San Luis del Rey, 3.

Dipodomys agilis simulans (Merriam)

J. A. Allen (Bull. Amer. Mus. Nat. Hist., 5:184, August 18, 1893) listed as *Perodipus agilis* a specimen (6306/4941 AMNH) from Valladares, Baja California. Subspecies of this species were subsequently named without mentioning this specimen that, on geographic grounds, might be either *D. a. martirensis* or *D. a. simulans.* Certain measurements of the specimen are as follows: Total length, 288; length of tail, 171; length of hind foot (dry), 41.0; greatest length of skull, 39.5; width of maxillary arch at middle, 4.5. The long tail and wide (4.5) maxillary arch are characteristic of *Dipodomys agilis simulans* and constitute the basis for identifying the specimen as of that subspecies.

Baiomys taylori analogus Osgood

The geographic range currently assigned to *Baiomys taylori paulus* (J. A. Allen) is separated in two parts by the geographic range assigned to *B. t. analogus.* The southern, separated part of the range of *B. t. paulus* rests wholly on ten specimens from Colima, Colima, identified as *B. t. paulus* by Osgood in his "Revision of the mice of the American genus Peromyscus" (N. Amer. Fauna, 28, April 17, 1909) where (p. 255) he places as a synonym of *Peromyscus taylori paulus* J. A. Allen, 1903, *Peromyscus allex* Osgood, 1904. The later name was based on these ten specimens (33422/45445-33427/45450, 33429/45452, 33432/45455, and 33435/45458 BS) from Colima. Osgood had a choice of synonymizing *P. allex* under *P. paulus* or *P. t. analogus.* According to Osgood's concept, *analogus* was blackish and large; *allex* was grayish and small; and *paulus* was fawn colored and intermediate in size. The more nearly equal size of *paulus* and *allex* probably influenced Osgood in making his choice. After examining the original materials we think there is more to recom-

mend the alternate choice. For example, two topotypes of equal age of the same sex of *allex* (33424/45447) and *analogus* (120264 BS) are of almost the same size and, respectively, measure as follows: Total length, 107, 108; length of tail, 42, 45; length of hind foot (measured dry), 13.1, 12.8; greatest length of skull, 17.6, 17.7; zygomatic breadth, 9.3, 9.2. Although *analogus* does average darker, a topotype, No. 120267 BS, from Zamora, is indistinguishable from several of the topotypes of *allex*. Consequently, we arrange *Peromyscus allex* Osgood as a synonym of *Baiomys taylori analogus* (Osgood) 1909 and refer the specimens from Colima to the latter.

Peromyscus eremicus eremicus (Baird)

Osgood (N. Amer. Fauna, 28:242, April 17, 1909) listed a specimen of this subspecies from Sierra Encarnación, Nuevo Leon. A specimen, No. 79614 BS, of this species was obtained on July 31, 1896, at Sierra Encarnación, Coahuila, by Nelson and Goldman. We known of no specimens of this subspecies from Sierra Encarnación, Nuevo Leon, and assume that Osgood referred to the Coahuilan specimen. Further support for this assumption is Osgood's (*loc. cit.*) note that the Sierra Encarnación specimen is aberrant and, to our eye, so is No. 79614 from Coahuila.

Peromyscus merriami merriami Mearns

Osgood (N. Amer. Fauna, 28:239, April 17, 1909) placed *P. merriami* in synonymy under *Peromyscus eremicus eremicus* (Baird). Because Seth B. Benson, and subsequently the late Wilfred H. Osgood, told one of us (Hall) that *Peromyscus merriami* was specifically distinct from *Peromyscus eremicus eremicus,* we have examined the specimens from Sonoyta, Sonora, and Quitobaquita, Arizona, referred by Mearns (Bull. U. S. Nat. Mus., 56:434-435, and 444, April 13, 1907) to *P. e. eremicus* and *P. merriami,* respectively. We perceive the differences that Mearns (*loc. cit.*) described and recognize *P. merriami* as a species separate from *P. eremicus.*

Also we have compared the type and one topotype of *Peromyscus goldmani* Osgood with the holotype and referred specimens mentioned above, of *P. merriami,* and feel that the two kinds are no more than subspecifically distinct. Accordingly, *P. goldmani* should stand as *Peromyscus merriami goldmani.* This arrangement is made with the knowledge that Burt (Misc. Publ. Mus. Zool., Univ. Michigan, 39:56, February 15, 1938) arranged *P. goldmani* as a synonym of *Peromyscus eremicus.*

Peromyscus truei preblei Bailey

Osgood (N. Amer. Fauna, 28:171, April 17, 1909) listed two specimens from Crooked River, 25 miles southeast of Prineville, Oregon, as *Peromyscus truei gilberti* with the notation "approaching *truei*?" Subsequently, Bailey (N. Amer. Fauna, 55:188, August 29, 1936) named *Peromyscus truei preblei* with type locality at Crooked River, 20 miles southeast of Prineville, a place from which Bailey had two specimens. We think the specimens recorded by the two authors are the same, and, according to the specimen labels, were placed correctly as to locality by Bailey. Our reasons are as follows: (a) The specimens mentioned by Bailey were presumably available to Osgood, but Osgood made no mention of specimens from "20 miles southeast of Prineville," (b) we find no specimens nor other records pertaining thereto, of *Peromyscus truei* from the locality given by Osgood, (c) Osgood indicated that the specimens he saw were not typical of *P. t. gilberti* and (d) *P. m. gilberti,* geographically the nearest subspecies, is recorded otherwise no closer to Prineville than Grants Pass, approximately 175 miles southwest in southwestern Oregon.

Sigmodon hispidus cienegae A. B. Howell

J. A. Allen (Bull. Amer. Mus. Nat. Hist., 5:28, March 16, 1893) listed as *Sigmodon hispidus arizonae* Mearns one specimen from Granados, Sonora, at a time when *S. h. cienegae* had not been named. We have examined the specimen (5389 AMNH) which has the skull inside and which lacks external measurements. It was taken on November 16, 1890, and is darker than specimens of *S. h. arizonae* collected in September at Fort Verde, Arizona. The color is essentially as in specimens of *S. h. cienegae* from Fairbank, Arizona (March-taken specimens). Because of this agreement in color and because of the geographic origin of the specimen from Granados, we refer the animal to *Sigmodon hispidus cienegae.*

Sigmodon hispidus zanjonensis Goodwin

Goodwin (Bull. Amer. Mus. Nat. Hist., 79:169, May 29, 1942) listed four specimens from Honduras (El Jaral, 2; and Las Ventanas, 2) as *Sigmodon hispidus saturatus* Bailey. Because these localities fall within the geographic range of *S. h. zanjonensis* we were lead to examine the specimens. Three are young and one (126113 AMNH from Las Ventanas) is an adult female. The underparts of the young are washed with rufous as in *S. h. saturatus.* The adult lacks this rufous as do specimens of *S. h. zanjonensis* and some

specimens of S. *h. saturatus.* In the adult the color of the upper parts and size of the upper cheek-teeth are intermediate between the dark-backed, small-toothed S. *h. saturatus* and the paler-backed, large-toothed S. *h. zanjonensis.* The rostrum is intermediate in width but definitely nearer the broad condition which obtains in S. *h. saturatus.* The tail is long, actually and in relation to the body (total length 275, tail 130), as in S. *h. zanjonensis* to which we refer the specimens in question.

Oryzomys couesi couesi (Alston)

For alleged occurrence at Reforma in Oaxaca, México (Goldman, N. Amer. Fauna, 43:31, September 23, 1918), see under *Oryzomys couesi mexicanus* Allen.

Oryzomys couesi mexicanus J. A. Allen

Goldman (N. Amer. Fauna, 43, September 23, 1918) listed, as in the Field Museum of Natural History [= Chicago Natural History Museum] one specimen from Reforma, Oaxaca, under *O. c. mexicanus* (p. 35) and one specimen from the same place under *O. c. couesi* (p. 31). In the Chicago Natural History Museum we can find only one specimen. It is a young male, skull with skin, in which the last molar has not yet erupted, and bears the catalogue number 13654. It is, in our opinion, referable to *O. c. mexicanus.* Because we suspect that Goldman (*op. cit.*) by error listed this one specimen twice (once under *O. c. couesi* and once under *O. c. mexicanus*) it seems best to exclude Reforma, Oaxaca, from the geographic range of *O. c. couesi.*

Oryzomys alfaroi saturatior Merriam

A series of *Oryzomys alfaroi* in the U. S. Biological Surveys Collection obtained at Tumbala, 5000 ft., Chiapas, México, the type locality of *Oryzomys alfaroi saturatior,* contains individuals some of which Goldman (N. Amer. Fauna, 43:66, September 23, 1918) referred to the subspecies *O. a. saturatior* and one which he referred to *O. a. palatinus.* This latter specimen, to judge from the external measurements given by Goldman (*loc. cit.*), is No. 76328. In comparison with the other material which Goldman saw, we find the specimen to agree with *O. a. palatinus* in pale color and posterior concavity of the posterior border of the palate. In some other diagnostic cranial characters, it is indistinguishable from specimens of *O. a. saturatior* from the same locality, and in other characters, notably the slenderness of the rostrum, it is intermediate between

the two subspecies concerned. In short, although we see the reasons for Goldman's subspecific identification of this individual, we think, in view of the structural intermediacy of the animal and the characters of the series *en masse*, that it is best referred to *Oryzomys alfaroi saturatior*.

Zapus princeps idahoensis Davis

Preble (N. Amer. Fauna, 15:23, August 8, 1899) referred two specimens from Henry House and three from 15 miles south of Henry House, both localities in Alberta, Canada, to the subspecies *Zapus princeps princeps*. Subsequently, when *Z. p. kootenayensis* (Anderson, Nat. Mus. Canada, Ann. Rept. 1931, p. 108, November 24, 1932) and *Z. p. idahoensis* (Davis, Jour. Mamm., 15(3):221, August 10, 1934) were named, no mention was made of these specimens although the ranges assigned to *Z. p. kootenayensis* and *Z. p. idahoensis* seemed to isolate the Henry House area from the remainder of the range (as recorded) of *Z. p. princeps*. We have examined the pertinent specimens in the U. S. Biological Surveys Collection (75452 and 75453 from Henry House; 81509-81510 from 15 mi. S Henry House). On the basis of paler color, reduced lateral line, smaller skull, shorter palatal bridge and zygomatic arches, they are, among named subspecies, best referred to *Zapus princeps idahoensis*.

Transmitted July 30, 1952.

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A Synopsis of
The North American Microtine Rodents

BY

E. RAYMOND HALL and E. LENDELL COCKRUM

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A Synopsis of The North American Microtine Rodents

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Meadow mice, voles, lemmings, collared lemmings, pine mice, red-backed mice, bog lemmings, tree mice, muskrat and round-tailed muskrat are the North American representatives of the subfamily Microtinae (family Muridae). This subfamily is confined to the northern hemisphere (if *Brachytarsomys* of Madagascar is not a microtine) and is typically boreal in distribution. In North America only a few species enter the Lower Sonoran Life-zone or the corresponding humid, Lower Austral Life-zone of the eastern United States. From these outposts of low zonal position the Microtinae extend upward through all of the life-zones. Geographically, in North America, the microtines occur from the northernmost land southward into Guatemala.

Students of public health have learned of several diseases that can be transmitted from microtine rodents—field mice in common parlance—to man. Figure 1 illustrates, for one of these diseases, some of the relationships between mice and men. A list of the diseases, in North America, and the microtines which have been identified either as carriers of the causative organisms or the vectors, are as follows:

Sylvatic Plague.—Plague is an acute infectious disease caused by the bacillus, *Pasteurella pestis,* and is usually considered under two headings: "Classical plague" is primarily an epidemic and endemic disease of rats (*Rattus*) that involves man only incidentally. "Sylvatic plague" is endemic among wild rodents throughout much of the western half of North America. Plague is spread from rodent to rodent and from rodent to man by the flea. The causative organism of plague has been recovered from tissues of the following North American microtines:

Microtus californicus (Lahnum, 1946:784).
Microtus townsendi (Lahnum, 1946:784).
Lagurus curtatus (Johnson, *et al.,* 1949:46).

Tularemia.—Tularemia, or "rabbit fever" is caused by a bacterium, *Pasteurella tularensis.* It is primarily a disease of rabbits and rodents but often is transmitted by insects, especially the deer fly, and is

occasionally transmitted to persons by their handling of infected animals. In man tularemia produces an irregular fever which continues for several weeks or months and in some cases is fatal if not treated. The causative organism of tularemia has been recovered from tissues of the following North American microtines:

Microtus californicus (Burroughs, *et al.*, 1945:115).
Microtus pennsylvanicus (Burroughs, *et al.*, 1945:118).
Microtus sp. ? from Alberta, Canada (Humpreys and Campbell, 1947:128).
Ondatra zibethicus (Schwartz, 1929:1180).

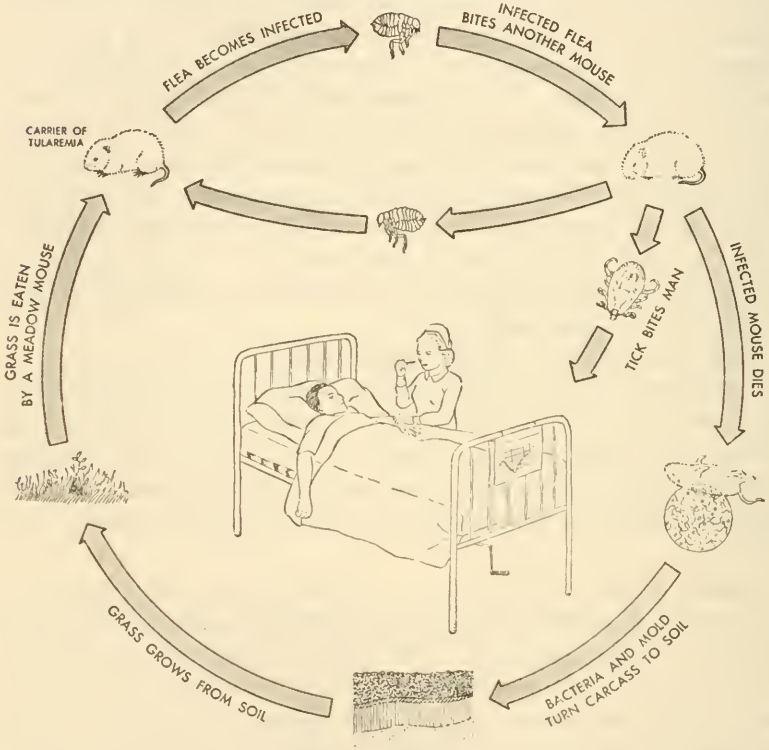


FIG. 1. Tularemia is a disease that affects both man and microtine rodents. Most kinds of diseases that rodents have do not affect man and *vice versa*.

Rocky Mountain Spotted Fever.—Spotted fever is caused by a rickettsial organism, *Rickettsia rickettsi*, and is transmitted by ticks of at least three species: *Dermacentor venustris* (= *D. andersoni*), *D. variabilis*, and *Amblyomma americanum*. Any one of these ticks requires a meal of blood before each of its molts and before egg laying, and a given tick usually acquires these meals from three different hosts, the last of which may be man. Although there is no proved animal reservoir of the rickettsial organism, several species

of native rodents are suspected of infecting ticks. Once infected, the tick may transmit the rickettsia to its next host. Ticks of either sex may carry the organism and remain infective for years. Infected females transmit the rickettsiae to the young by way of the egg. The following species of microtines are known to serve as hosts to the ticks which serve as vectors of this disease:

Microtus pinetorum (Hamilton, 1939:340).
Microtus pennsylvanicus pennsylvanicus (Cooley, 1938:26).
Microtus [pennsylvanicus] modestus (Cooley, 1938:35).
Microtus ochrogaster haydeni (Cooley, 1938:35).

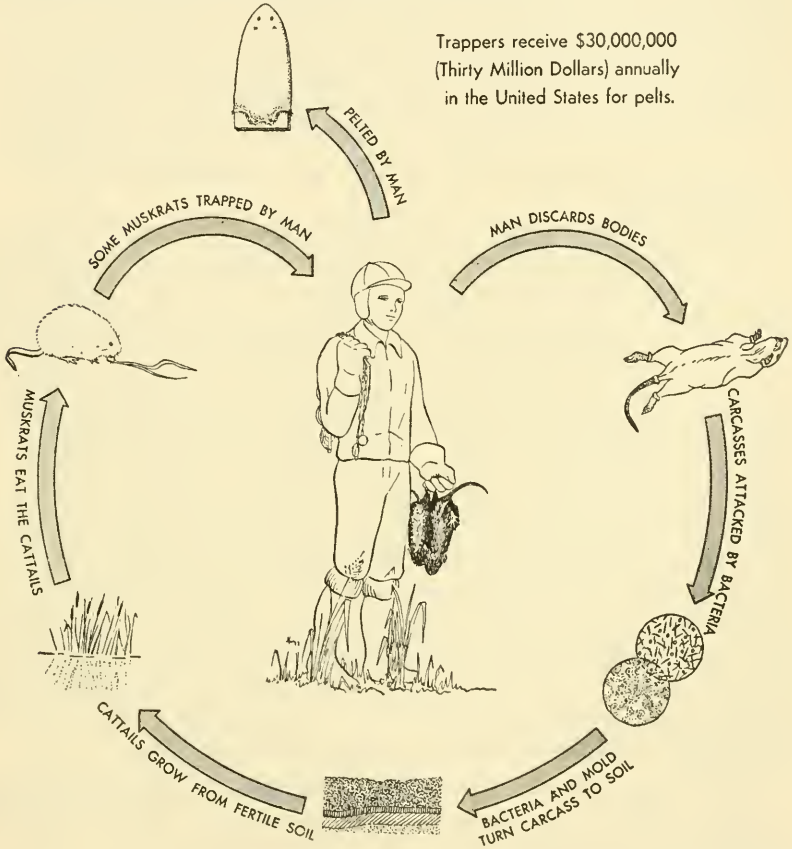


FIG. 2. The muskrat, a microtine rodent, is of great value to man; the fur alone yields United States citizens thirty million dollars a year. By wise management of ponds and sloughs the return could be much greater.

Rat-bite fever.—Rat-bite fever is an illness with a relapsing type of fever that develops following the bite of rodents infected with *Spirillum minus.* Most reported cases have resulted from the bite

of a rat (*Rattus*) but the causative organism has been isolated from at least one microtine (*Microtus* sp. from Montana) as reported by Jellison, *et al.* (1949:1665).

Foresters who are concerned with hazards to seeds and seedlings, nurserymen who are concerned with orchards, and students of wildlife who are concerned with food supplies for fur-bearing mammals need precise information on the kinds and geographic distribution of the microtine rodents. For example, microtines make up a full third or more of the winter food of the ermine, a valuable fur-bearing mammal, in many areas (Hall, 1951B:91). One microtine itself, the muskrat, yields a huge annual return in fur; see figure 2.

It is to meet the needs of these several groups of biologists, and especially the group that is concerned with diseases transmissible to man, that the present synopsis is offered in advance of an account, in preparation, along similar lines, of all of the native mammals of North America.

In the present account we aim first to show, by means of maps, the geographic distribution of the different kinds of microtines, and second make clear the zoological classification of each species and subspecies. Although much of the information previously was in the literature, the information was not assembled in any one publication. In general, the kind of information and the plan of its arrangement closely correspond to that in the recently published "A Synopsis of the North American Lagomorpha" (see Hall, 1951A).

Persons who use the present account of the microtine rodents should know that for each subspecies, or species if it has not been divided into subspecies, there is given (1) the scientific name; (2) a citation to the original description followed by a statement of the type locality; (3) a citation to the account in which the combination of names (generic, specific, and subspecific) used in the present account was first used unless this be the same as (2) above; (4) synonyms arranged in chronological order; and (5) marginal records of occurrence together with the sources of these records.

These marginal records are arranged in clockwise order beginning with the northernmost locality. If more than one of the marginal localities lies on the line of latitude that is northernmost for a given kind of mammal, the westernmost of these is recorded first. The marginal localities that are represented by symbols on the corresponding distribution map are in Roman type; those that could not be represented on the map, because undue crowding or overlapping of symbols would have occurred, are in Italic type.

Measurements are in millimeters. Capitalized color terms are after Ridgway (Color Standards and Color Nomenclature, Washington, D. C., 1912), and uncapitalized terms refer to no particular color standard, or to an unknown standard in instances where material is taken *verbatim* from earlier accounts.

As concerns the dual authorship of this paper, Cockrum verified each marginal record of occurrence that previously had been entered on preliminary work maps, which had been prepared under the general supervision of Hall. Cockrum checked these records against the original citations. He added records from the collections of the University of Kansas Museum of Natural History and from publications not examined when the original maps were prepared and he wrote the first draft of the manuscript. Hall checked the synonymy, and concerned himself primarily with the accounts of genera and species.

Acknowledgment of assistance is made first to those who provided legislative funds for research use by the University of Kansas. A contract (NR 160-187) between the Office of Naval Research, Department of the Navy, and the University of Kansas supported the assistants who prepared the preliminary distribution maps. Assistance with out-of-state field work by the Kansas University Endowment Association yielded specimens that provide several of the marginal records of occurrence. At the University of Kansas Museum of Natural History, James W. Bee, Nora Marie Mason Heck, George C. Rinker, Austin B. Williams, and especially Keith R. Kelson, among others, have given substantial help with one or another phase of the work. Dr. A. Remington Kellogg has made available some information that otherwise would have been overlooked. Several of the drawings of skulls were reproduced originally in the "Mammals of Nevada" (Hall, 1943) and we are grateful to the University of California Press for permission to use them here. Initials on the drawings identify the artists as: Freda L. Abernathy; Harry C. Adamson; Mary Blos; Louise Brunk; Jeanne W. Fitch; Richard Phillip Grossenheider; Victor Hogg; Viola Memmler; Barbara Trotter; and Virginia (Cassel) Unruh.

Subfamily MICROTINAE

Revised by Miller, N. Amer. Fauna, 12:1-84, July 23.

Diagnosis.—This subfamily of the family Muridae can be characterized as: Thickset animals with bluntly rounded muzzles; most of each limb hidden in the general integument of the trunk, thus resulting in a short-legged appearance; five toes on each foot; tail never so long as head and body; postorbital processes

absent; outer wall of infraorbital canal transverse or oblique to long axis of skull and with front edge emarginate or undercut and not projecting in front of anterior border of superior ramus of maxillary root of zygoma; palatine bones notably thick; ectopterygoid plates well developed; cheek-teeth twelve (three on each side of upper- and lower-jaw), long crowned and in most genera persistently growing; occlusal faces made up of triangles and loops.

Key to Genera of North American Microtines

(After Ellerman, 1941:550-555)

1. Lower incisors wholly lingual to molars and terminating in horizontal ramus opposite, or in front of, alveolus of m3.
   2. Cheek-teeth longitudinally complex (many loops); inner and outer salient angles approximately equal in size; m1 with seven closed triangles between terminal loops; supraorbital ridges strong but not fusing in interorbital region; foreclaws of D2 and D3 with periodic seasonal (winter) extra basal growths ..... *Dicrostonyx*, p. 479
   2'. Cheek-teeth longitudinally simplified (few loops); inner salient angles of upper molars and outer angles of lower molars smaller than those of the opposite sides; m1 with three closed triangles between termination loops (or with two transverse loops, if closed triangles absent); supraorbital ridges fusing in adults and forming median orbital crest; foreclaws not developing seasonal outgrowths.
      3. Posterior palate not terminating as simple transverse shelf; upper incisors strongly grooved; tooth-rows not, or less widely, divergent posteriorly; forefeet not much specialized in that claws are not notably thickened, soles almost hairless and ungual phalanges not notably lengthened ..... *Synaptomys*, p. 473
      3'. Posterior palate terminating as a simple transverse shelf; upper incisors not grooved; tooth-rows widely divergent posteriorly; forefeet specialized in that claws of some individuals are notably thickened, soles almost concealed by hairs, and ungual phalanges notably lengthened. ..... *Lemmus*, p. 470
1'. Lower incisors passing from lingual to labial side of molars between bases of roots of m2 and m3 and ascending behind molars to termination within or near condylar process.
   4. Cheek-teeth rooted in adults.
      5. External form modified for aquatic life in that tail is laterally compressed, and swimming fringes on hind feet conspicuous; basal length of skull more than 50 mm. *Ondatra*, p. 464
      5'. External form not modified for aquatic life; basal length of skull less than 50 mm.
         6. Posterior palate terminating as a simple transverse shelf; lower molars with inner re-entrant angles little if any deeper than outer re-entrant angles. *Clethrionomys*, p. 381
         6'. Posterior palate terminating with a median spinous process converted into a sloping septum between posterolateral pits; lower molars with inner re-entrant angles deeper than outer. ..... *Phenacomys*, p. 395

4′. Cheek-teeth not rooted (evergrowing) in adults.

7. External form lemminglike in that ears are so short as to be concealed in fur and tail is so short as to extend scarcely beyond hind feet in prepared skins; tympanic bullae and mastoid bullae much enlarged (see figures 93 and 113); M1 and M2 with traces of extra complexities between main inner folds (m1 with 5 closed triangles).
Lagurus, p. 452

7′. External form volelike (not lemminglike) in that ears are not entirely concealed in fur and tail extends beyond hind feet in prepared skins; tympanic bullae and mastoid bullae of normal size (see figures 92, 94, 112 and 115); M1 and M2 usually without traces of extra complexities between the main inner folds (m1 with 3, 4, or 5 closed triangles).

8. Underfur muskratlike in that it obviously is adapted to aquatic existence; m3 with triangles (only 2 between terminal loops) tightly closed; alveolar length of upper molars more than 9.9 mm. ..... *Neofiber*, p. 455

8′. Underfur mouselike in that it is not adapted to aquatic existence; m3 without tightly closed triangles; alveolar length of upper molars less than 9.9 mm. ..... *Microtus*, p. 402

Genus CLETHRIONOMYS Tilesius—Red-backed Mice

1850. *Clethrionomys* Tilesius, Isis, 2:28. Type, *Mus glareolus* Schreber.
1874. *Evotomys* Coues, Proc. Acad. Nat. Sci. Philadelphia, p. 186, December 15. Type, *Mus rutilus* Pallas.
1900. *Craseomys* Miller, Proc. Washington Acad. Sci., 2:87, July 26. Type, *Hypudaeus rufocanus* Sundevall.
1905. *Paulomys* Thomas, Ann. and Mag. Nat. Hist., ser. 7, 15:493. Type, *Evotomys smithii* Thomas.

Ellerman and Morrison-Scott (Checklist of Palaearctic and Indian Mammals, 1758-1946, British Museum (Natural History), November 19, 1951), on page 659, suggest that the three names listed below are synonyms of *Clethrionomys*.

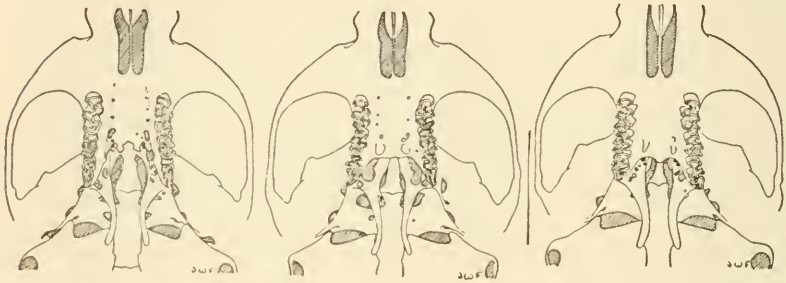
1898. *Aschizomys* Miller, Proc. Acad. Nat. Sci. Philadelphia, p. 369, October 11. Type, *Aschizomys lemminus* Miller.
1911. *Caryomys* Thomas, Abstr. Proc. Zool. Soc. London, p. 4, February 14, Proc. Zool. Soc. London, p. 175. Type, *Microtus* (*Eothenomys*) *inez* Thomas.
1935. *Neoaschizomys* Tokuda, Mem. Coll. Sci. Kyoto, ser. B, 10(No. 3):241. Type, *Neoaschizomys sikotanensis* Tokuda.

Total length, 120-165; tail, 50-53; hind foot, 16-21.0; ear from notch, 10-16; weight (of *C. gapperi*), 16-42 grams; basal length of skull, 21.0-24.3; zygomatic breadth, 12.5-14.4. External form not much modified, back usually red; mammae 2-2 = 8; plantar pads 6. Skull "weak"; temporal ridges poorly developed and not fused an-

teriorly in interorbital region in adults; interorbital constriction medium; braincase broad; bullae relatively large, lacking spongy tissue (in living species); palate ends posteriorly as straight transverse shelf with no median septum; cheek-teeth rooted in adults.

Key to the Species of Clethrionomys

1. Postpalatal bridge incomplete except in an occasional extremely old individual; tail short, thick, and with closely set bristly hairs (*rutilus* group).
   2. Restricted to St. Lawrence Island; condylobasal length of skull more than 26.0 mm.; zygomatic breadth more than 14.0 mm. *C. albiventer*, p. 384
   2′. Not on St. Lawrence Island but mainly on mainland; condylobasal length of skull less than 26.0 mm.; zygomatic breadth less than 14.0 mm. ..... *C. rutilus*, p. 382



3 4 5

Figs. 3-5. Palates of skulls of three species of *Clethrionomys*.

Fig. 3. *C. rutilus dawsoni*, 15 mi. SE Northway, Alaska; ♀ 21410 KU.

Fig. 4. *C. gapperi galei*, 3 mi. S Ward, Colorado; ♂ 20602 KU.

Fig. 5. *C. occidentalis obscurus*, Upper Munson Meadows, Crater Lake Nat'l Park, Oregon; ♀ 22161 KU.

1′. Postpalatal bridge complete even in half-grown young; tail slender, and with short hairs except at the tip where hairs are longer.
   3. Postpalatal bridge truncate posteriorly; dentition relatively light, enamel pattern of M3 more complex; postpalatal process light (see figure 4) ..... *C. gapperi*, p. 385
   3′. Postpalatal bridge with median posteriorly directed spine; dentition relatively heavy, enamel pattern of M3 more simplified, postpalatal process heavy (see figure 5) ..... *C. occidentalis*, p. 391

Clethrionomys rutilus

Northern Red-backed Mouse

Total length, 130-158; tail, 30-44; hind foot, 18.5-21; ear, 10-14. Upper parts bright; dorsal stripe well defined, varying from bright reddish to dark rufous; sides grayish; venter grayish with the tips of guard hairs varying from whitish to deep buff; tail sharply bi-

colored, varying from reddish to blackish above. Tail short, thick and closely set with bristly hairs. Postpalatal bridge incomplete except occasionally in extremely old individuals; enamel patterns of M3 and m1 more complex than in *C. occidentalis.* Embryos for 17 females from Alaska and Yukon number 6.6 (5 to 9).

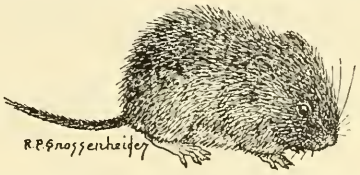


FIG. 6. *Clethrionomys rutilus dawsoni,* Yerrick Creek, Alaska, July 22, 1947; ♀ 21389 KU. × ½

CLETHRIONOMYS RUTILUS DAWSONI (Merriam).

1888. *Evotomys dawsoni* Merriam, Amer. Nat., 22:650, July, type from Finlayson River, 3000 ft., a northern source of the Liard River, lat. 61° 30′ N; long. 129° 30′ W, Yukon.
1898. *Evotomys alascensis* Miller, Proc. Acad. Nat. Sci. Philadelphia, 50:364, October 15, type from St. Michael, Norton Sound, Alaska. (See Osgood, N. Amer. Fauna, 24:34, November 23, 1904.)
1950. *Clethrionomys rutilus dawsoni,* Rausch, Jour. Washington Acad. Sci., 40:134, April 21.

Marginal records.—Alaska: 1½ mi. ESE Point Barrow, 10 ft. (43327 KU); 1¼ mi. W, ¾ mi. N Umiat, 69° 22′ 18″, 152° 08′ 10″, 370 ft.(43328 KU). Mackenzie District: Fort McPherson (Preble, 1908:180); Port Epworth (Anderson, 1937:112); Bathurst Inlet (Banfield, 1951:118); Muskox Lake (*ibid.*); Thelon Game Sanctuary (Anderson, 1947:154). Manitoba: Nonala, 80 mi. N Churchill (Orr, 1945:71). Mackenzie District: Fort Reliance (Banfield, 1951:118); Fort Rae (Preble, 1908:180); Fort Providence (*ibid.*). British Columbia: Summit Pass, 4500 ft., 10 mi. S, 70 mi. W Fort Nelson (Baker, 1951:103); Level Mtn. (Allen, 1903:547); Junction (Swarth, 1922:173). Alaska: Juneau (Anderson, 1947:154); Yakutat (*ibid.*); Mt. Logan Area, Hubrick's Camp [N side Chitina River, 25 mi. W Alaska-Yukon line] (Laing, Taverner, and Anderson, 1929:101); Moose Camp, Kenai Peninsula (Orr, 1945:71); Ugaguk River, near outlet Becharof Lake (Osgood, 1904:33); Nushagak (*ibid.*); St. Michael (Osgood, 1900:35); Teller (Anderson, 1937:112).

CLETHRIONOMYS RUTILUS GLACIALIS Orr.

1945. *Clethrionomys dawsoni glacialis* Orr, Jour. Mamm., 26:71, February 27, type from Glacier Bay, Alaska.
1950. *Clethrionomys rutilus glacialis,* Rausch, Jour. Washington Acad. Sci., 40:135, April 21.

Marginal records (Orr, 1945:72).—Alaska (Glacier Bay): Coppermine; *Bartlett Cove.*

CLETHRIONOMYS RUTILUS INSULARIS (Heller).

1910. *Evotomys dawsoni insularis* Heller, Univ. California Publ. Zool., 5:339, March 5, type from west side Canoe Passage, Hawkins Island, Prince William Sound, Alaska.

1950. *Clethrionomys rutilus insularis,* Rausch, Jour. Washington Acad. Sci., 40:135, April 21.

Marginal records (Orr, 1945:72).—Alaska (Prince William Sound): type locality; Northeast Bay, Hinchinbrook Island.

Clethrionomys rutilus orca (Merriam).

1900. *Evotomys orca* Merriam, Proc. Washington Acad. Sci., 2:24, March 14, type from Orca, Prince William Sound, Alaska.
1950. *Clethrionomys rutilus orca,* Rausch, Jour. Washington Acad. Sci., 40:135, April 21.

Marginal records (Orr, 1945:73).—Alaska (Prince William Sound): Valdez Narrows; Cordova; La Touche, La Touche Island; head of Port Nellie Juan.

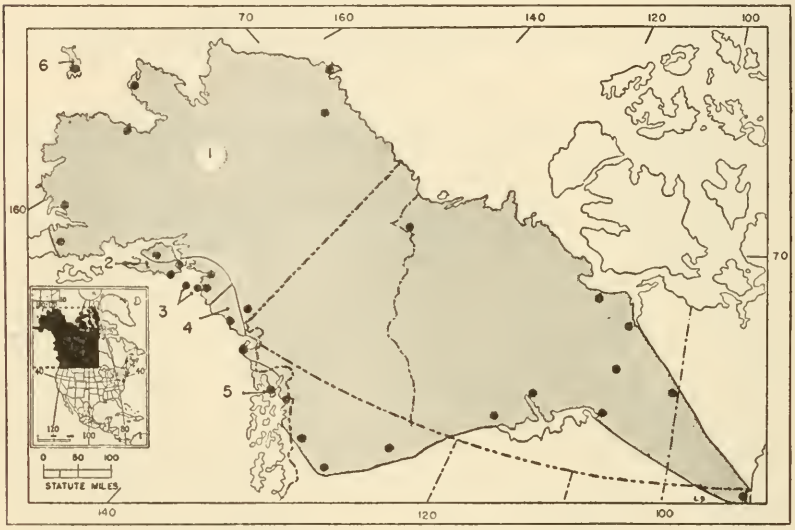


Fig. 7. Distribution of *C. rutilus* and *C. albiventer.*

1. *C. rutilus dawsoni*
2. *C. rutilus orca*
3. *C. rutilus insularis*
4. *C. rutilus watsoni*
5. *C. rutilus glacialis*
6. *C. albiventer*

Clethrionomys rutilus watsoni Orr.

1945. *Clethrionomys dawsoni watsoni* Orr, Jour. Mamm., 26:73, February 27, type from Cape Yakataga, Alaska. Known from type locality only.
1950. *Clethrionomys rutilus watsoni,* Rausch, Jour. Washington Acad. Sci., 40:135, April 21.

Cleithrionomys albiventer Hall and Gilmore

St. Lawrence Island Red-backed Mouse

1932. *Clethrionomys albiventer* Hall and Gilmore, Univ. California Publ. Zool., 38:398, September 17, type from Sevoonga, 2 mi. E of North Cape, St. Lawrence Island, Bering Sea, Alaska. Known from type locality only.

Total length, 150-153; tail, 31-37; hind foot, 20-21. Upper parts pale; dorsal stripe well defined, Sudan brown; sides gray, lacking buff; feet and belly clear pale olive-gray; tail sharply bicolored, gray

below, Sudan brown above. Known from only three specimens. Closely related to *C. rutilus* but skull larger.

Clethrionomys gapperi

Gapper Red-backed Mouse

Total length, 120-158; tail, 30-50; hind foot, 16-21; ear, 12-16; weight, 16-42 grams. Dorsal stripe varies from bright chestnut, through hazel, to yellowish brown; sides gray to buffy gray, sometimes with yellowish wash; venter silvery sometimes with buffy wash; tail bicolor, whitish to gray below, dark brown to black above. Tail slender, with short hairs except at tip where hairs are longer. Postpalatal bridge complete even in half-grown young with result that posterior margin of palate forms solid, truncate shelf; dentition relatively light; enamel patterns of M3 and m1 more complex than in *C. occidentalis*. Usual number of embryos 4 to 6 (extremes recorded are 3 to 8).

Clethrionomys gapperi arizonensis Cockrum and Fitch.

1952. *Clethrionomys gapperi arizonensis* Cockrum and Fitch, Univ. Kansas Publ., Mus. Nat. Hist., 5:291, November 15, type from Little Colorado River, 8300 ft., White Mts., Apache Co., Arizona.

Marginal records (Cockrum and Fitch, 1952:291).—Arizona: type locality; *Hannagan Creek, 8600 ft.*

Clethrionomys gapperi athabascae (Preble).

1908. *Evotomys gapperi athabascae* Preble, N. Amer. Fauna, 27:178, October 26, type from Fort Smith, Slave River, Mackenzie.
1932. *Clethrionomys gapperi athabascae,* Harper, Jour. Mamm., 13:28, February 9.

Marginal records.—Mackenzie District: Fort Resolution (Preble, 1908:179); Soulier Lake (Harper, 1932:28). *Northern Saskatchewan and NW Manitoba* (Anderson, 1947:152). Alberta: Calling River (Preble, 1908:179); Edmonton (*ibid.*); Tornado Pass (Crowe, 1943:404). British Columbia: Invermere (*ibid.*). Alberta: Jasper Nat'l Park (Anderson, 1947:152). British Columbia: Laurier Pass (east end) (Sheldon, 1932:200); 5 mi. W, 3 mi. N Fort St. John (Baker, 1951:104); Liard River (Anderson, 1947: 152).

Clethrionomys gapperi brevicaudus (Merriam).

1891. *Evotomys gapperi brevicaudus* Merriam, N. Amer. Fauna, 5:119, July 30, type from 3 mi. N Custer, 6000 ft., Black Hills, Custer Co., South Dakota.
1942. *Clethrionomys gapperi brevicaudus,* Bole and Moulthrop, Sci. Publ. Cleveland Mus. Nat. Hist., 5:153, September 11.

Marginal records (Cockrum and Fitch, 1952:288, unless otherwise noted).—Wyoming: 3 mi. NW Sundance, 5900 ft. South Dakota: Deadwood (Bailey, 1897:129); 16 mi. SW Rapid City; *type locality.* Wyoming: 12 mi. SE Newcastle, *1½ mi. E Buckhorn, 6150 ft.*

CLETHRIONOMYS GAPPERI CAROLINENSIS (Merriam).

1888. *Evotomys carolinensis* Merriam, Amer. Jour. Sci., ser. 3, 36:460, December, type from Roan Mtn., 6000 ft., Mitchell Co., North Carolina.
1939. *Clethrionomys gapperi carolinensis*, R. Kellogg, Proc. Biol. Soc. Washington, 52:38, March 11.

Marginal records.—West Virginia: Hardy County (Wilson, 1943:102); Franklin (Kellogg, 1937:467); Cranberry Glades (*ibid.*). Virginia: Whitetop Mtn. (Handley and Patton, 1947:171). North Carolina: type locality; Highlands (Odum, 1949:191). Tennessee: Spence Field, 1 mi. W Thunderhead Mtn. (Kellogg, 1939:284). West Virginia: Odd (Kellogg, 1937:467); Cheat Mtn., 3 mi. E Cheat Bridge (*ibid.*).

CLETHRIONOMYS GAPPERI CASCADENSIS Booth.

1945. *Clethrionomys gapperi cascadensis* Booth, Murrelet, 26:27, August 10, type from 2 mi. S Blewett Pass, 3000 ft., Kittitas Co., Washington.

Marginal records (Booth, 1945:28, unless otherwise noted).—Washington: Nooksak River; Pasayten River; Liberty; Simcoe Mts.; Mt. St. Helens (Dalquest, 1948:342); Swamp Creek (*ibid.*).

CLETHRIONOMYS GAPPERI GALEI (Merriam).

1890. *Evotomys galei* Merriam, N. Amer. Fauna, 4:23, October 8, type from Ward, 9500 ft., Boulder Co., Colorado.
1931. *Clethrionomys gapperi galei*, Hall, Univ. California Publ. Zool., 37:6, April 10.

Marginal records.—Alberta: "extreme southwestern Alberta" (Anderson, 1947:152). Montana: Big Snowy Mts. (Bailey, 1897:127). Wyoming (Cockrum and Fitch, 1952:284): 6½ mi. W, 2 mi. S Buffalo; 22 mi. S, 24½ mi. W Douglas; 3 mi. ESE Browns Peak. Colorado: type locality; Lake Moraine, 10,250 ft. (Warren, 1942:224); 2 mi. N Gothic (937 J. S. Findley Collection); 25 mi. SE Meeker (Cary, 1911:121). Wyoming: Bridger Pass, 18 mi. SW Rawlins (20597 KU); Middle Lake, 20½ mi. W, 2 mi. S Lander (37798 KU); Hoback Mts. (Bole and Moulthrop, 1941:153); Moran (17268 KU). Montana: Deer Lodge County (1013 KU); St. Mary Lake (Bailey, 1918:60).

CLETHRIONOMYS GAPPERI GAPPERI (Vigors).

1830. *Arvicola gapperi* Vigors, Zool. Jour., 5:204, type from between York [= Toronto] and Lake Simcoe, Ontario.
1928. *Clethrionomys gapperi gapperi*, Green, Jour. Mamm., 9:255, August 9.
1894. *Evotomys fuscodorsalis* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:103, April 14, type from Trousers Lake, New Brunswick.

Marginal records.—Quebec: Godbout (Bailey, 1897:124); Lake Edward (Elliot, 1907:284). New York: Lake George (Bailey, 1897:124). Connecticut: Woodstock (Goodwin, 1935:129); Glastonbury (*ibid.*). New Jersey: Walkill Valley, near Long Lake (Stone, 1908:68). Virginia (Patton, 1939:76 unless otherwise noted): Washington; Peaks of Otter; Mountain Lake (Handley and Patton, 1947:171); Elliot Knob. Pennsylvania: Renovo (Bailey, 1897:124). Ontario: Middlesex County (Saunders, 1932: 297). Michigan (Burt, 1946:215); Alcona County; *Crawford County;* Leelanau County. Wisconsin: 1 mi. W Keshena (Komarek, 1932:208); Beaver Dam (Cory, 1912:211); Worden (Schmidt, 1931:103). Minnesota

(Swanson, 1945:90): Carlton County; Lake of the Woods County. Ontario: Humboldt Bay, Lake Nipigon region (Dymond, 1928:245). Quebec: Bark Lake (Bole and Moulthrop, 1942:153).

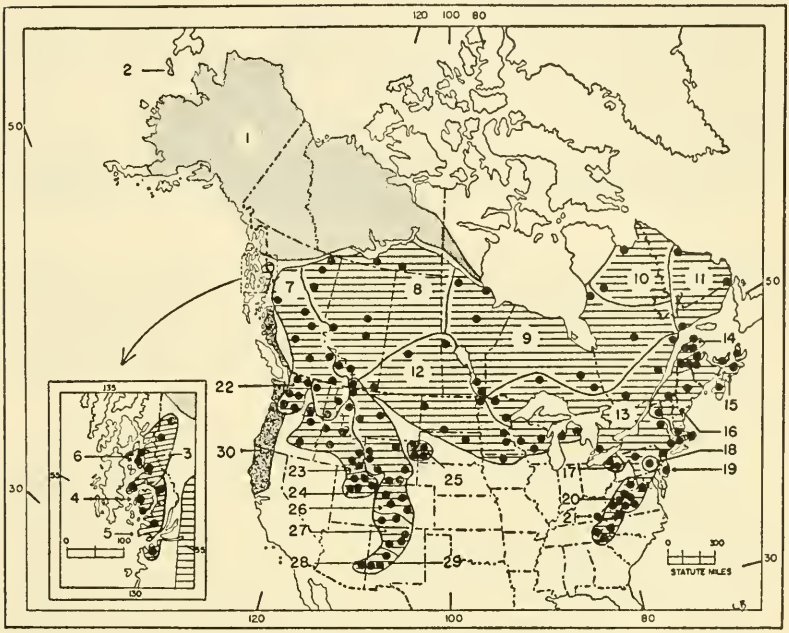


FIG. 8. Distribution of *Clethrionomys*.

1. *C. rutilus* (fig. 7).
2. *C. albiventer*
3. *C. g. sitkinensis*
4. *C. g. solus*
5. *C. g. phaeus*
6. *C. g. wrangeli*
7. *C. g. saturatus*
8. *C. g. athabascae*
9. *C. g. hudsonius*
10. *C. g. ungava*
11. *C. g. proteus*
12. *C. g. loringi*
13. *C. g. gapperi*
14. *C. g. gaspeanus*
15. *C. g. pallescens*
16. *C. g. ochraceus*
17. *C. g. paludicola*
18. *C. g. rupicola*
19. *C. g. rhoadsii*
20. *C. g. carolinensis*
21. *C. g. marus*
22. *C. g. cascadensis*
23. *C. g. idahoensis*
24. *C. g. uintaensis*
25. *C. g. brevicaudus*
26. *C. g. galei*
27. *C. g. gauti*
28. *C. g. arizonensis*
29. *C. g. limitis*
30. *C. occidentalis* (fig. 9).

CLETHRIONOMYS GAPPERI GASPEANUS Anderson.

1943. *Clethrionomys gapperi gaspeanus* Anderson, Ann. Rept. for 1942, Provancher Soc. Nat. Hist. Canada, p. 57, September 7, type from Berry Mountain Camp, about 1500 ft., near junction of Berry Mountain Brook with Grand Cascapedia River, Matane Co., Quebec.

Marginal records.—Quebec: Ste. Anne de Monts (Anderson, 1943:59); *type locality;* Red Camp, Cascapedia Valley (Goodwin, 1929:243). New Brunswick: Dalhousie (Elliot, 1907:283); St. Leonard (Anderson, 1943: 59); Baker Lake (*ibid.*). Quebec: Matapedia (Elliot, 1907:283). *Note:* Anderson (1947:152) implies that Dalhousie, N. B., and Matapedia, Quebec, are in the range of *C. g. gaspeanus*.

Clethrionomys gapperi gauti Cockrum and Fitch.

1952. *Clethrionomys gapperi gauti* Cockrum and Fitch, Univ. Kansas Publ., Mus. Nat. Hist., 5:289, November 15, 1952, type from Twining, 10,700 ft., Taos Co., New Mexico.

Marginal records (Cockrum and Fitch, 1952:290).—Colorado: 21 mi. W, 3 mi. N Saguache. New Mexico: 15 mi. SW Cimarron; Pecos Baldy, Pecos Mts.; Goat Peak, Jemez Mts. Colorado: Silverton.

Clethrionomys gapperi hudsonius Anderson.

1940. *Clethrionomys gapperi hudsonius* Anderson, Rapport Annuel 1939, Société Provancher d'Histoire Naturelle du Canada, p. 73, February 29, type from Kapuskasing, on Kapuskasing River, about 64 mi. W Cochrane, Ontario.

Marginal records.—Manitoba: Sandhill Lake (59° 21′ N, 98° 43′ W) (Anderson, 1947:152); [Fort] Churchill (*ibid.*). Quebec: Richmond Gulf (*op. cit.*:153); Lake Albanel (Cameron and Morris, 1951:128). Ontario: Murdock Creek, S of Swastika (Anderson, 1940:75); type locality. Manitoba: Whitemouth Lake (Soper, 1946:146); Pine Falls (*ibid.*); Ilford (Anderson, 1947:152).

Clethrionomys gapperi idahoensis (Merriam).

1891. *Evotomys idahoensis* Merriam, N. Amer. Fauna, 5:66, July 30, type from Sawtooth (Alturas) Lake, 7200 ft., E base Sawtooth Mts., Blaine Co., Idaho.
1933. *Clethrionomys gapperi idahoensis,* Whitlow and Hall, Univ. California Publ. Zool., 40:265, September 30.

Marginal records.—Montana: Yellow Bay, Flathead Lake region (Dice, 1923:250). Idaho (Davis, 1939:311): Salmon River Mts. [= Timber Creek, Lemhi Mts.]; 3 mi. S Victor; N rim Copenhagen Basin; Indian Creek; Edna. Oregon * (Bailey, 1897:129): 10 mi. N Harney; Kamela. Washington: Humpeg Falls (Dice, 1919:14). Idaho: ½ mi. E Black Lake (Davis, 1939:311).

* Note: The findings of Davis (1939:310) and Dalquest (1948:343) suggest that *C. g. idahoensis* and not *C. g. saturatus* is the subspecies in eastern Oregon.

Clethrionomys gapperi limitis (Bailey).

1913. *Evotomys limitis* Bailey, Proc. Biol. Soc. Washington, 26:133, May 21, type from Willow Creek, 8500 ft., a branch of the Gilita, Mogollon Mts., Socorro Co., New Mexico.
1952. *Clethrionomys gapperi limitis,* Cockrum and Fitch, Univ. Kansas Publ., Mus. Nat. Hist., 5:290, November 10.

Marginal records (Cockrum and Fitch, 1952:291).—New Mexico: Copper Canyon, Magdalena Mts.; San Mateo Peak, 10,000 ft., San Mateo Mts.; type locality.

Clethrionomys gapperi loringi (Bailey).

1897. *Evotomys gapperi loringi* Bailey, Proc. Biol. Soc. Washington, 11:125, May 13, type from Portland, Traill Co., North Dakota.
1929. *Clethrionomys gapperi loringi,* B. Bailey, Jour. Mamm., 10:162, May 9.

Marginal records.—Manitoba: Cormorant Lake, mile 42 from The Pas on the Churchill R. R. (Breckenridge, 1936:62, as *C. g. gapperi,* but falls in the range ascribed by Anderson [1947:153] to *C. g. loringi*). Minnesota: Kitt-

son County (Swanson, 1945:90); Hinckley (Bailey, 1897:126); Minneapolis (*ibid.*). Iowa: 5 mi. E [=ESE] Forest City (84194 U. Mich.). South Dakota: Fort Sisseton (Bailey, 1897:126). North Dakota (Bailey, 1926:88): Cannon Ball; Buford. Alberta: Cypress Hills, Eagle Butte (Soper, 1946: 146). Saskatchewan: Wingard (Bailey, 1897:124, *Evotomys* [*g.*] *gapperi*).

Clethrionomys gapperi maurus R. Kellogg.

1939. *Clethrionomys gapperi maurus* R. Kellogg, Proc. Biol. Soc. Washington, 52:37, March 11, type from Black Mts., 4½ mi. SE Lynch, 4100 ft., Harlan Co., Kentucky.

Marginal records.—Kentucky: type locality. *Virginia: Big Stone Gap* (Handley and Patton, 1947:171).

Clethrionomys gapperi ochraceus (Miller).

1894. *Evotomys gapperi ochraceus* Miller, Proc. Boston Soc. Nat. Hist., 26:193, March 24, type from Mt. Washington, 5500 ft., Coos Co., New Hampshire.
1929. [*Clethrionomys gapperi*] *ochraceus*, Goodwin, Jour. Mamm., 10:243, August 10.

Marginal records.—Prince Edward Island: Kensington (Elliot, 1907:284), thence south along Atlantic Coast to: Massachusetts: Wareham (Bole and Moulthrop, 1942:153); Petersham (Parker, 1939:411). New York: St. Huberts (Bole and Moulthrop, 1942:153). Quebec: Hatley (Anderson, 1940:76). Maine: South Twin Lake (Elliot, 1907:283). New Brunswick (Elliot, 1907:283): *Andover;* Trousers Lake (specimens from the three localities last mentioned were recorded as *Evotomys* [*g.*] *gapperi* but fall in the range ascribed by Anderson [1947:153] to *C. g. ochraceus*).

Clethrionomys gapperi pallescens Hall and Cockrum.

1940. *Clethrionomys gapperi rufescens* R. W. Smith, Amer. Midland Nat., 24:233, July, type from Wolfville, Kings County, Nova Scotia (*nec Arvicola rufescens* de Selys Longchamps 1836, a synonym of *Clethrionomys glareolus glareolus* Schreber 1780).
1952. *Clethrionomys gapperi pallescens* Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:302, November 17 (as substitute for *C. g. rufescens* Smith).

Marginal records (Smith, 1940:234).—Nova Scotia: Frizzleton, down east coast of Cape Breton Island and Nova Scotia and back up west coast to Albany; thence to James River.

Clethrionomys gapperi paludicola Doutt.

1941. *Clethrionomys gapperi paludicola* Doutt, Proc. Biol. Soc. Washington, 54:162, December 8, type from Pymatuning Swamp, 1000 ft., 4 mi. W Linesville, Crawford Co., Pennsylvania.

Marginal records.—Ohio: Conneaut Creek [=Farnham] (Bole and Moulthrop, 1942:152); *Padanaram* (Bole and Moulthrop, 1942:153). Pennsylvania: type locality.

Clethrionomys gapperi phaeus (Swarth).

1911. *Evotomys phaeus* Swarth, Univ. California Publ. Zool., 7:127, January 12, type from Marten Arm, Boca de Quadra, Alaska.
1952. *Clethrionomys gapperi phaeus*, Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:302, November 17.

Marginal records (Hall and Cockrum, 1952:303).—Alaska: Chickamin River; type locality. British Columbia: Fort [=Port] Simpson.

Clethrionomys gapperi proteus (Bangs).

1897. *Evotomys proteus* Bangs (in Bailey), Proc. Biol. Soc. Washington, 11:137, May 13, type from Hamilton Inlet, Labrador.
1938. *Clethrionomys gapperi proteus*, C. F. Jackson, Jour. Mamm., 19:433, November 14.

Marginal records.—Labrador: Nain (Anderson, 1940:76); Black Bay (Jackson, 1938:433); near mouth of Moise River (*ibid.*). Not found: Assiwaban River (Anderson, 1947:153) and Windsor (Anderson, 1940: 76).

Clethrionomys gapperi rhoadsii (Stone).

1893. *Evotomys gapperi rhoadsii Stone*, Amer. Nat., 27:55, January, type from Mays Landing, Atlantic Co., New Jersey. Known only from vicinity of type locality. (Bole and Moulthrop [Sci. Publ. Cleveland Mus. Nat. Hist., 5:153, September 11, 1942] record from Lakehurst Ocean Co., New Jersey; Miller [Bull. N. Y. State Mus., 8:111, 1900] lists from southern New York.)
1942. *Clethrionomys gapperi rhoadsii*, Bole and Moulthrop, Sci. Publ. Cleveland Mus. Nat. Hist., 5:153, September 11.

Clethrionomys gapperi rupicola E. L. Poole.

1949. *Clethrionomys gapperi rupicola* E. L. Poole, Not. Naturae Acad. Nat. Sci. Philadelphia, 212:2, January 21, type from Pinnacle, Berks Co., Pennsylvania. Known only from Kittatinny Ridge of Berks and Schuylkill cos., Pennsylvania.

Clethrionomys gapperi saturatus (Rhoads).

1894. *Evotomys gapperi saturatus* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 46:284, October 23, type from Nelson, British Columbia, on Kootenai River, 30 mi. N northern boundary of Washington.
1933. [*Clethrionomys gapperi*] *saturatus*, Whitlow and Hall, Univ. California Publ. Zool., 40:265, September 30.

Marginal records.—British Columbia: Hazelton (Hall, 1934:376); Summit Lake (Munro, 1947:142); Indianpoint Lake (Hall, 1934:376); Glacier (Bailey, 1897:129); Kitchener (Munro, 1950:86). Montana: Prospect Creek (Bailey, 1897:129). Idaho: Craig Mt. (Davis, 1939:312). Washington: Sherman Creek Pass (Dalquest, 1948:342). British Columbia: Caribou Lake, near Kamloops (Anderson, 1947:153); Chilcotin River (Racey and Cowan, 1935:H 25).

Clethrionomys gapperi stikinensis Hall and Cockrum.

1952. *Clethrionomys gapperi stikinensis* Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:305, November 17, type from Stikine River at Great Glacier, British Columbia.

Marginal records (Hall and Cockrum, 1952:307).—British Columbia: type locality; Stikine River at Flood Glacier. Alaska: Bradfield Canal; Helm Bay.

Clethrionomys gapperi solus Hall and Cockrum.

1952. *Clethrionomys gapperi solus* Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:304, November 17, type from Loring, Revillagigedo Island, Alaska.

Marginal records (Hall and Cockrum, 1952:305).—Alaska (Revillagigedo Island): type locality; mouth of Fish Creek, Ketchikan.

Clethrionomys gapperi uintaensis Doutt.

1941. *Clethrionomys gapperi uintaensis* Doutt, Proc. Biol. Soc. Washington, 54:161, December 8, type from Paradise Park, 10,050 ft., Uintah Co., Utah.

Marginal records (Durrant, 1952:356, unless otherwise indicated).—Utah: Monte Cristo, 18 mi. W Woodruff, 8000 ft. Wyoming: 9 mi. S Robertson (26069 KU). Utah: Beaver Dams, 10,500 ft.; *type locality;* Bald Peak, Uinta Mts., 10,500 ft.; Silver Lake Post Office (Brighton), 9,500 ft.; *Emigration Canyon, 8 mi. above forks, 6,000 ft.*

Clethrionomys gapperi ungava (Bailey).

1897. *Evotomys ungava* Bailey, Proc. Biol. Soc. Washington, 11:130, May 13, type from Fort Chimo, Quebec.
1939. *Clethrionomys gapperi ungava* Anderson, Ann. Rept. Provancher Soc. Nat. Hist. Canada for 1938:83, February 28.

Marginal records.—Quebec: type locality; Lower Seal Lake (Anderson, 1940:76).

Clethrionomys gapperi wrangeli (Bailey).

1897. *Evotomys wrangeli* Bailey, Proc. Biol. Soc. Washington, 11:120, May 13, type from Wrangell, Wrangell Island, Alaska.
1952. *Clethrionomys gapperi wrangeli*, Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:303, November 17.

Marginal records (Hall and Cockrum, MS).—Alaska: Sergief Island; Wrangell, Wrangell Island.

Clethrionomys occidentalis

Western Red-backed Mouse

Total length, 121-165; tail 34-53; hind foot, 18-21; ear 10-13; upper parts usually somber; dorsal stripe usually not well defined but rather obscured by intermixed black hairs, and varying from light hazel to deep chestnut; sides light to dark-buffy gray; venter with buffy or ochraceous wash over dark or plumbeous underfur; tail varying from indistinctly to sharply bicolor, dusky to sooty above, whitish below. Tail slender, and with short hairs except at tip where they are long.

Postpalatal bridge complete even in half-grown young with result that posterior margin of palate forms solid shelf with median, posteriorly directed spine; dentition relatively heavy; enamel patterns of M3 and m1 simplified as compared with those of *C. gapperi* (number of salient and re-entrant angles tend to be reduced in adults).

Arthur Svihla (Murrelet, 12:54, May 1931) has written essentially as follows concerning this mouse on the Olympic Peninsula, of Washington. The gestation period was 18 days in a female that was bred no longer than 12 hours after she had given birth to one litter. Gravid females were found in the autumn (September). At birth the appearance is similar to that of *Clethrionomys gapperi*. The young are born with the eyes closed and hairless, except for the vibrissae, which already are in evidence. The animal is a bright flesh-color but within 20 hours the back becomes darkly pigmented owing to the growth of the hair. Within a week the body is covered by hair that is darker gray than in the adult. The eyes open on the 14th day after birth. As soon as the eyes open, weaning commences and the young gradually become less dependent on the mother for food. Little is known of the food except that it is vegetable material. The numbers of young in three litters born in captivity were 3, 3 and 4. MacNab and Dirks (1941:177) reported two females, one with two and one with four embryos. Bailey (1936:193) reported that: "like other forms of the genus the young probably vary from 4 to 8 in a litter."

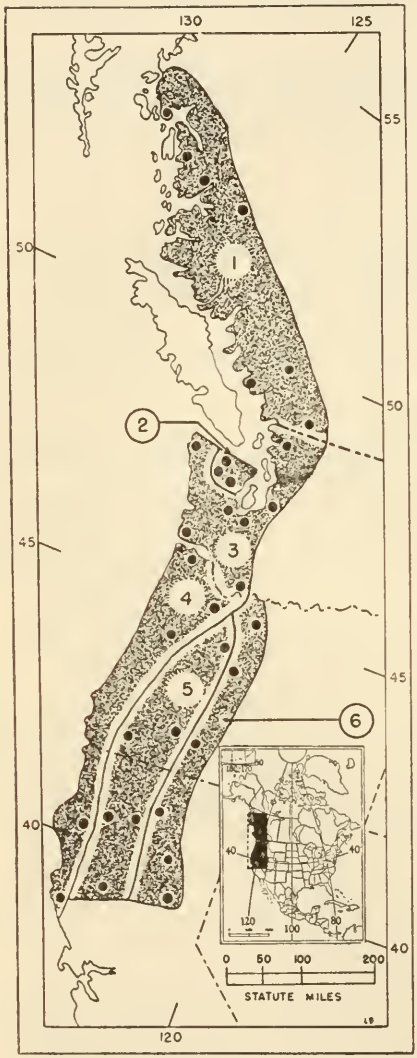


FIG. 9. Distribution of *Clethrionomys occidentalis*.

1. *caurinus*
2. *nivarius*
3. *occidentalis*
4. *californicus*
5. *obscurus*
6. *mazama*

Traps set crosswise of the trails under logs, or traps set close to the junction of the log and the ground, often capture specimens of this species.

Clethrionomys occidentalis californicus (Merriam).

1890. *Evotomys californicus* Merriam, N. Amer. Fauna, 4:26, October 8, type from Eureka, Humboldt Co., California.
1952. *Clethrionomys occidentalis californicus,* Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:301, November 17.

Marginal records.—Oregon (MacNab and Dirks, 1941:177-178): Astoria; Camp Millard, near Estacada; Wells. California (Grinnell, 1933:185): near Fair Oaks; *Willits;* 7 mi. W Cazadero, thence north along coast.

Clethrionomys occidentalis caurinus (Bailey).

1898. *Evotomys caurinus* Bailey, Proc. Biol. Soc. Washington, 12:21, January 27, type from Lund, east shore of Malaspina Inlet, British Columbia.
1952. *Clethrionomys occidentalis caurinus,* Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:299, November 17.

Marginal records.—British Columbia: Inverness, mouth of Skeena River (Hall and Cockrum, 1952:300); Kutze Inlet (Racey and Cowan, 1935: H 25); Kimsquit (Anderson, 1947:152); Stuie (*ibid.*); Alta Lake (Racey and Cowan, 1935: H26); Chilliwack Val. (Anderson, 1947:152); type loc.

Clethrionomys occidentalis mazama (Merriam).

1897. *Evotomys mazama* Merriam, Proc. Biol. Soc. Washington, 11:71, April 21, type from Crater Lake, 7000 ft., Mt. Mazama, Oregon.
1952. *Clethrionomys occidentalis mazama,* Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:301, October 17.

Marginal records.—Oregon: Mt. Hood (Bailey, 1897:132); The Three Sisters (Bailey, 1936:193); type locality. California: Mt. Shasta (Grinnell, 1933:184); vicinity Lassen Peak (Grinnell, 1933:184); near Quincy (*ibid.*).

Clethrionomys occidentalis nivarius (Bailey).

1897. *Evotomys nivarius* Bailey, Proc. Biol. Soc. Washington, 11:136, May 13, type from NW slope Mt. Ellinor, 4000 ft., Olympic Mts., Washington.
1952. *Clethrionomys occidentalis nivarius,* Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:300, November 17.

Marginal records.—Washington: Lake Sutherland (Taylor and Shaw, 1929:24); Staircase, on Lake Cushman (Dalquest, 1948:343); Sol Duc Hot Springs (*ibid.*).

Clethrionomys occidentalis obscurus (Merriam).

1897. *Evotomys obscurus* Merriam, Proc. Biol. Soc. Washington, 11:72, April 21, type from Prospect, 2600 ft., Upper Rogue Riv. Val., Oreg.
1952. *Clethrionomys occidentalis obscurus,* Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:302, November 17.

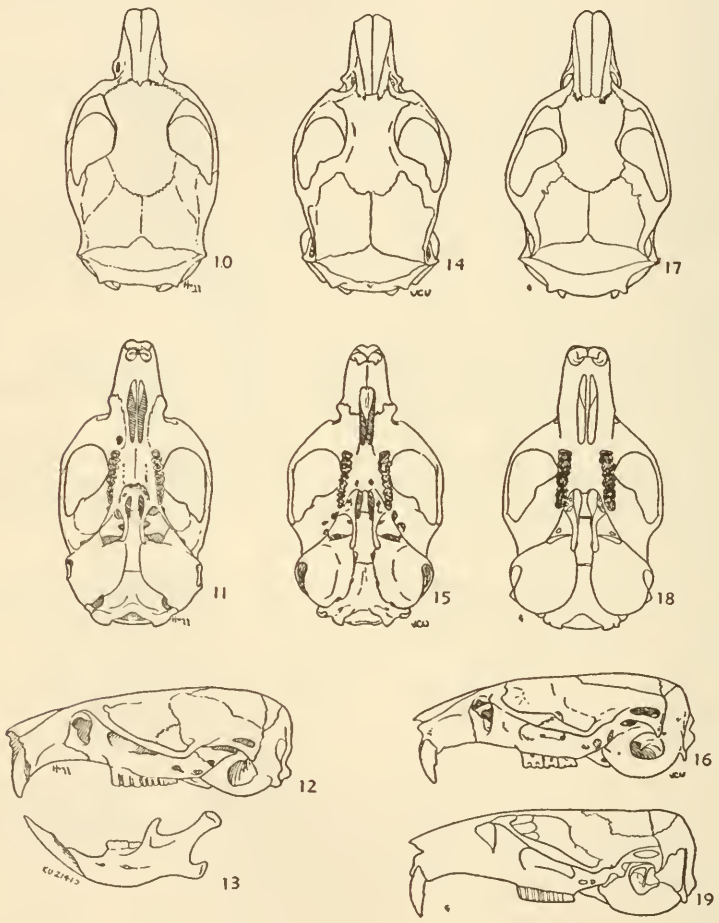
Marginal records.—Oregon: W base Mt. Jefferson (Bailey, 1936:192); W side Crater Lake (Bailey, 1897:133). California (Grinnell, 1933:185): Castle Lake; 2 mi. S of South Yolla Bolly Mtn.; Jackson Lake. Oregon: Grants Pass (Bailey, 1936:192).

Clethrionomys occidentalis occidentalis (Merriam).

1890. *Evotomys occidentalis* Merriam, N. Amer. Fauna, 4:25, October 8, type from Aberdeen, Grays Harbor Co., Washington.
1894. *Evotomys pygmaeus* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 46: 284, October 23, type from mouth Nisqually River, Pierce Co., Wash.

1952. *Clethrionomys occidentalis occidentalis*, Hall and Cockrum, Univ. Kansas Publs., Mus. Nat. Hist., 5:301, November 17.

Marginal records.—Washington: Lake Whatcom (Taylor and Shaw, 1929: 23); Cottage Lake (Dalquest, 1948:344); Steilacoom (Bailey, 1897:136); 15 mi. N Carson (Taylor and Shaw, 1929:23); Ilwaco (*ibid.*); Ozette Lake (*ibid.*); near Shelton (Dalquest, 1948:344).



FIGS. 10-19. Skulls of red-backed mice, *Clethrionomys*. All × 1½.

FIGS. 10-13. *C. rutilus dawsoni*, east side Deadman Lake, 1300 ft., 15 mi. SE Nordway, Alaska; ♀ 21410 KU.

FIGS. 14-16. *C. gapperi galei*, 3 mi. ESE Browns Peak, 10,000 ft., Albany Co., Wyoming; ♂ 17288 KU.

FIGS. 17-19. *C. occidentalis obscurus*, head of Daggett Creek, 5800 ft., Siskiyou Co., California; ♀ 69490 MVZ.

Genus PHENACOMYS Merriam

Revised by A. B. Howell, N. Amer. Fauna, 48:iv + 66, October 12, 1926.

1889. *Phenacomys* Merriam, N. Amer. Fauna, 2:28, October 30. Type, *Phenacomys intermedius* Merriam.
1915. *Arborimus* Taylor, Proc. California Acad. Sci., ser. 4, 5:119, December 30. Type, *Phenacomys longicaudus* True.

Total length, 130-193; tail, 26-87; hind foot, 16-22. Basal length, 22.3-25.7; zygomatic breadth, 13.9-16.3. Upper parts gray to cinnamon. Mammae usually 2-2 = 8; plantar pads 6. Skull with temporal ridges widely separated in adult; bullae of medium size, without internal spongy tissue; palate neither transversely continuous nor shelflike; cheek-teeth rooted in adults; enamel pattern of lower molars unique, chiefly in depth of re-entrant angles, as compared with the external angles.

KEY TO THE SPECIES OF PHENACOMYS

1. Tail much less than 50 mm. ..... *P. intermedius*, p. 395
1'. Tail much more than 50 mm.
  2. Incisors strongly recurved (see fig. 35); tail thick, quite hairy; arboreal.
    3. Color reddish; braincase relatively unridged; nose not sooty. *P. longicaudus*, p. 399
    3'. Color brownish; braincase strongly ridged; nose sooty. *P. silvicola*, p. 399
  2'. Incisors not strongly recurved (see fig. 29); tail slender, scantily haired; terrestrial ..... *P. albipes*, p. 398

Phenacomys intermedius

Heather Vole

Total length, 130-153; tail, 26-41; hind foot, 16-18.2; ear, 11-17; weight, up to 40.8 grams. Upper parts agouti gray to brownish but face, in some subspecies, yellowish; underparts whitish; tail sharply bicolored. Embryos, in three females from Wyoming, numbered 3, 4, and 8.

PHENACOMYS INTERMEDIUS CELATUS Merriam.

1889. *Phenacomys celatus* Merriam, N. Amer. Fauna, 2:33, October 30, type from Godbout, Quebec.
1889. *Phenacomys latimanus* Merriam, N. Amer. Fauna, 2:34, October 30, type from Fort Chimo, Quebec.
1889. *Phenacomys ungava*, Merriam, N. Amer. Fauna, 2:35, October 30, type from Fort Chimo, Quebec. (This name selected to apply to the subspecies by Miller, Proc. Biol. Soc. Washington, 11:84, April 21, 1897 and was used by Howell (N. Amer. Fauna, 48:25, October 12, 1926) who revised the members of the genus *Phenacomys*.)
1926. *Phenacomys ungava ungava*, A. B. Howell, N. Amer. Fauna, 48:25, October 12.

1943. *Phenacomys intermedius ungava,* Crowe, Bull. Amer. Mus. Nat. Hist., 80:404, February 4.

Marginal records.—Quebec: Fort Chimo (Jackson, 1938:433); Harrington Harbor (Weaver, 1940:419); type locality. Ontario: Nipissing (Anderson, 1942:58); Algoma (*ibid.*); Kenora (*ibid.*); Lake Abitibi (Snyder, 1928:12).

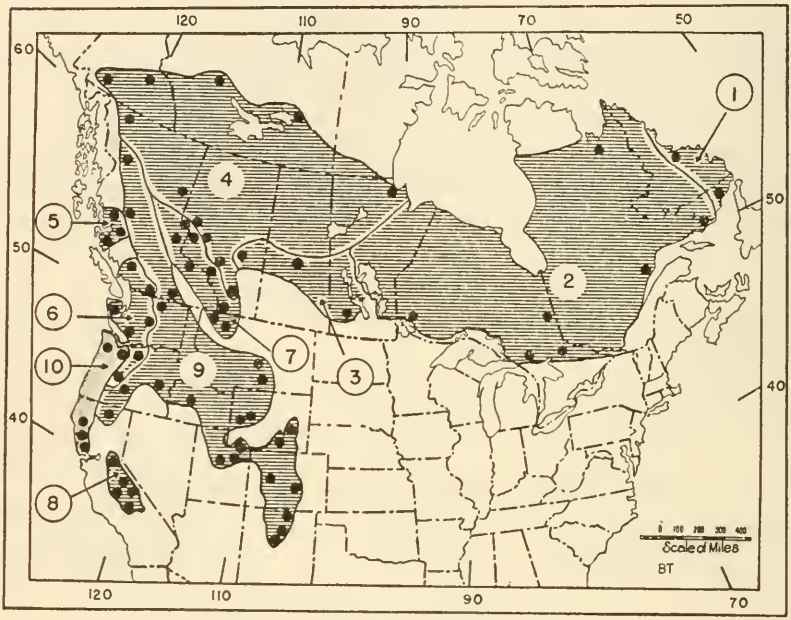


Fig. 20. Distribution of *Phenacomys intermedius* and *P. longicaudus.*

Guide to species
1. *P. i. crassus*
2. *P. i. celatus*
3. *P. i. soperi*
4. *P. i. mackenzii*
5. *P. i. laingi*
6. *P. i. oramontis*
7. *P. i. levis*
8. *P. i. celsus*
9. *P. i. intermedius*
10. *P. longicaudus*

Phenacomys intermedius celsus A. B. Howell.

1923. *Phenacomys intermedius celsus* A. B. Howell, Proc. Biol. Soc. Washington, 36:158, May 1, type from Muir Meadow, 9300 ft., Tuolumne Meadows, Yosemite Nat'l Park, California.

Marginal records.—California: Pyramid Peak (Grinnell, 1933:183); Ten Lakes, Yosemite Park (A. B. Howell, 1926:25); Mt. Lyell (*ibid.*); Humphreys Basin (Grinnell, 1933:183); Fletcher Creek, Yosemite Park (A. B. Howell, 1926:25).

Phenacomys intermedius crassus Bangs.

1900. *Phenacomys celatus crassus* Bangs, Proc. New England Zool. Club, 2:39, September 20, type from Rigolet, Hamilton Inlet, Labrador.
1943. *Phenacomys intermedius crassus,* Crowe, Bull. Amer. Mus. Nat. Hist., 80:404, February 4.

Marginal records (Anderson, 1942:57).—Labrador: type locality; L'Anse au Loup, Strait of Belle Isle.

PHENACOMYS INTERMEDIUS INTERMEDIUS Merriam.

1889. *Phenacomys intermedius* Merriam, N. Amer. Fauna, 2:32, October 30, type from a basaltic plateau, 5500 ft., about 20 mi. NNW Kamloops, British Columbia.

1891. *Phenacomys orophilus* Merriam, N. Amer. Fauna, 5:65, July 30, type from near head of Timber Creek, Lemhi Mts. [= "Salmon River Mountains"], Lemhi Co., Idaho.

1894. *Phenacomys truei* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:331, November 7, type from Black Hills, now Laramie Mts., Wyoming.

1897. *Phenacomys preblei* Merriam, Proc. Biol. Soc. Washington, 11:45, March 16, type from side of Twin Peak, 9000 ft., near Longs Peak, Boulder Co., Colorado.

1899. *Phenacomys constablei* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 12:4, March 4, type from Telegraph Creek, British Columbia.

Marginal records (Howell, 1926:19-20, unless otherwise noted).—British Columbia: Telegraph Creek; Nelson. Montana: Big Snowy Mts.; Bear Tooth Mts. Wyoming: 18 mi. W, 3 mi. N Lander (32753 KU); Merna; 11½ mi. S, 2 mi. E Robertson, 9200 ft. (26059 KU); Bridgers Pass, 18 mi. SW Rawlins, 7500 ft. (20609 KU); Laramie Mts.(= Black Hills). Colorado: Lake Moraine (Warren, 1942:223). New Mexico: Twining; Pecos Baldy; Santa Fe. Colorado: Sacramento Gulch (Warren, 1942:223). Utah: Provo River, 3 mi. N Soapstone G. S., Wasatch Nat'l Forest (Durrant, 1952:360); Mt. Timpanogos, 10,200 ft. (*ibid.*). Idaho: Sawtooth City (Davis, 1939:305). Oregon: Blue Mts. California: Mt. Shasta. Oregon: Diamond Lake. Washington: [Okanagan Co.] Loomis. British Columbia: Wistaria, near Burns Lake (Anderson, 1942:59).

PHENACOMYS INTERMEDIUS LAINGI Anderson.

1942. *Phenacomys intermedius laingi* Anderson, Canadian Field-Nat., 56:59, June 8, type from Kimsquit River, Cornice Creek, near head of Dean Inlet, 52° 54′ N and 127° W, 2500 ft., British Columbia.

Marginal records.—British Columbia: type locality; Atnarko River (Anderson, 1947:149); Mt. Brilliant (Anderson, 1942:59).

PHENACOMYS INTERMEDIUS LEVIS A. B. Howell.

1923. *Phenacomys intermedius levis* A. B. Howell, Proc. Biol. Soc. Washington, 36:157, May 1, type from Saint Marys Lake, Teton Co., Montana.

Marginal records (Howell, 1926:21, unless otherwise noted).—Alberta: head of Smoky River; Thoral Creek, 6000 ft. (Crowe, 1943:403); Braggs Creek; Waterton Lakes Nat'l Park (Anderson, 1942:58). Montana: Midvale; *Summit;* Kintla Lake. British Columbia: Assiniboine, 7500 ft. (Crowe, 1943:403); Moose River.

PHENACOMYS INTERMEDIUS MACKENZII Preble.

1902. *Phenacomys mackenzii* Preble, Proc. Biol. Soc. Washington, 15:182, August 6, type from Fort Smith, Slave River, Mackenzie.

1943. *Phenacomys intermedius mackenzii,* Crowe, Bull. Amer. Mus. Nat. Hist., 80:403, February 4.

Marginal records.—Mackenzie: Lake St. Croix (Howell, 1926:29); Fort Reliance (Banfield, 1951:118). Manitoba: Churchill (Anderson, 1942:57). Alberta: Mud Lake, near Macleod (Crowe, 1943:403); *Maycroft, 4700 ft.* (*ibid.*); Bearberry Creek, W of Olds (Anderson, 1942:58); Entrance, 3000 ft. (Crowe, 1943:403); Muskeg Creek (*ibid.*). British Columbia: Charlie Lake (Cowan, 1939:83); Atlin (Swarth, 1936:403). Yukon: SE end Dezadeash Lake (Baker, 1951:104); Lapie Lakes, Canol Road (Anderson, 1947:151); *Lapie River, Canol Road* (*ibid.*).

Phenacomys intermedius oramontis Rhoads.

1895. *Phenacomys oramontis* Rhoads, Amer. Nat., 29:941, October, type from Church Mtn. (Lihumitson Mtn.), 6000 ft., Lihumitson Park, Mt. Baker Range, New Westminster District, British Columbia.

1899. *Phenacomys olympicus* Elliot, Field Columb. Mus., publ. 30, zool. ser., 1:225, February 2, type from Happy Lake, 5000 ft., Olympic Mts., Clallam Co., Washington. Anderson (Canadian Field-Nat., 56:59, June 8, 1942) considers *P. olympicus* to be a synonym of *P. i. oramontis* Rhoads.

1899. *Microtus* (*Lagurus*) *pumilus* Elliot, Field Columb. Mus., publ. 30, zool. ser., 1:226, February 2, type from Happy Lake, Olympic Mts., Clallam Co., Washington. Dalquest (Univ. Kansas Publ., Mus. Nat. Hist., 2:340, April 9, 1948) considers *M. pumilus* to be a synonym of *P. i. oramontis* Rhoads.

1942. *Phenacomys intermedius oramontis,* Anderson, Canadian Field-Nat., 56:59, June 8.

Marginal records.—British Columbia: Avalanche Pass, 5,500 ft. (Racey and Cowan, 1935:H25); type locality. Washington: nr. Stephens Pass (Dalquest, 1948:339). Oregon (A. B. Howell, 1926:23): Deschutes River; Three Sisters; *Mt. Hood.* Washington (A. B. Howell, 1926:23): Canyon Creek; Boulder Lake.

Phenacomys intermedius soperi Anderson.

1942. *Phenacomys ungava soperi* Anderson, Canadian Field-Nat., 56:58, June 8, type from near Swanson Creek, in middle of sec. 34, T. 19, R. 17, Riding Mtn. Nat'l Park, Manitoba.

1943. *Phenacomys intermedius soperi,* Crowe, Bull. Amer. Mus. Nat. Hist., 80:404, February 4.

Marginal records (Anderson, 1942:59).—Saskatchewan: Emma Lake, SE of Prince Albert Nat'l Park. Manitoba: type locality. Alberta: Battle Lake (head of Battle River).

Phenacomys albipes Merriam

White-footed Phenacomys

1901. *Phenacomys albipes* Merriam, Proc. Biol. Soc. Washington, 14:125, July 19, type from Redwoods, near Arcata, Humboldt Bay, Humboldt Co., California.

Marginal records (Howell, 1926:31).—Oregon: Netarts; Vida. California: type locality.

Average external measurements of six adult males: total length, 171 (165-181); tail, 63 (62-71); hind foot, 19.5 (19-20). Upper parts close to Prout Brown, with mixture of black-tipped hairs. Underparts clear gray, often washed with pinkish buff in autumn.

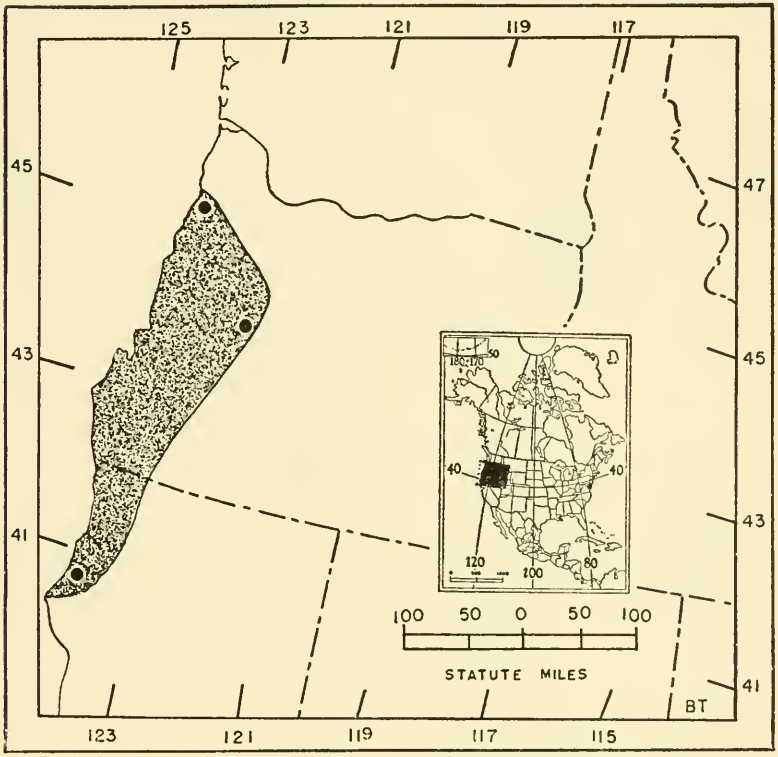


FIG. 21. Distribution of *Phenacomys albipes*, white-footed phenacomys.

Phenacomys silvicola A. B. Howell

Dusky Tree Mouse

1921. *Phenacomys silvicolus* A. B. Howell, Jour. Mamm., 2:98, May 2, type from 5 mi. SE Tillamook, Tillamook Co., Oregon.

Marginal records.—Oregon: 3 or 4 mi. W Tillamook (Walker, 1930:233); *type locality*; near Corvallis (Bailey, 1936:198).

External measurements of one male and one female are: total length, 193, 191; tail, 87, 81; hind foot, 20, 22. Upper parts near cinnamon brown, with a sooty nose; underparts whitish. Tail long and well haired. Wight (1925:283) recorded 4 young associated with one female.

Phenacomys longicaudus True

Red Tree Mouse

1890. *Phenacomys longicaudus* True, Proc. U. S. Nat. Mus., 13:303, November 15, type from Marshfield, Coos Co., Oregon.

Marginal records.—Oregon (Jewett, 1920:167): Nehalem; Bonneville. California: 1 mi. W Bridgeville (Benson and Borell, 1931:226); Mt. Sanhe-

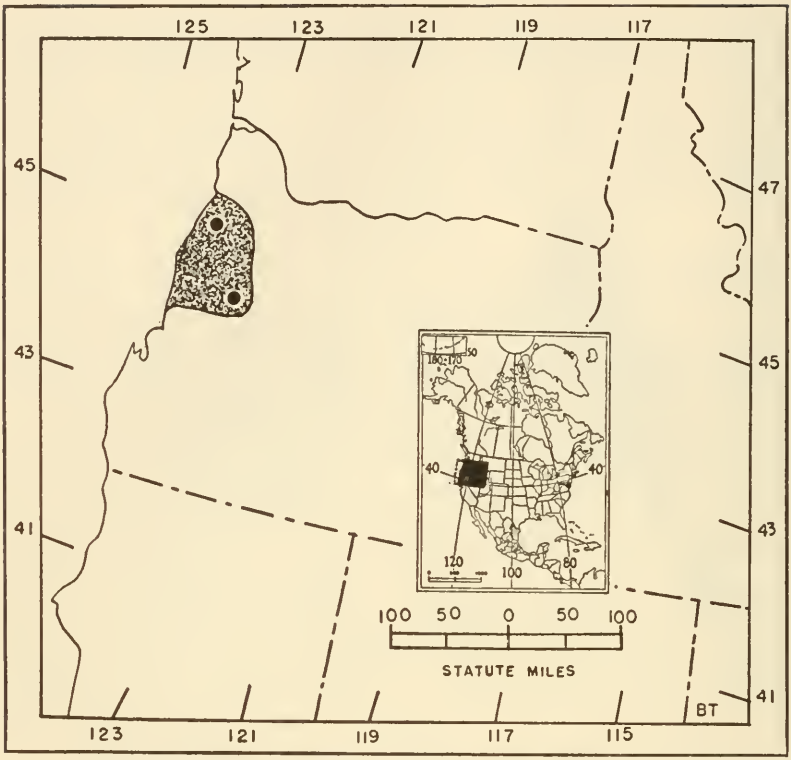
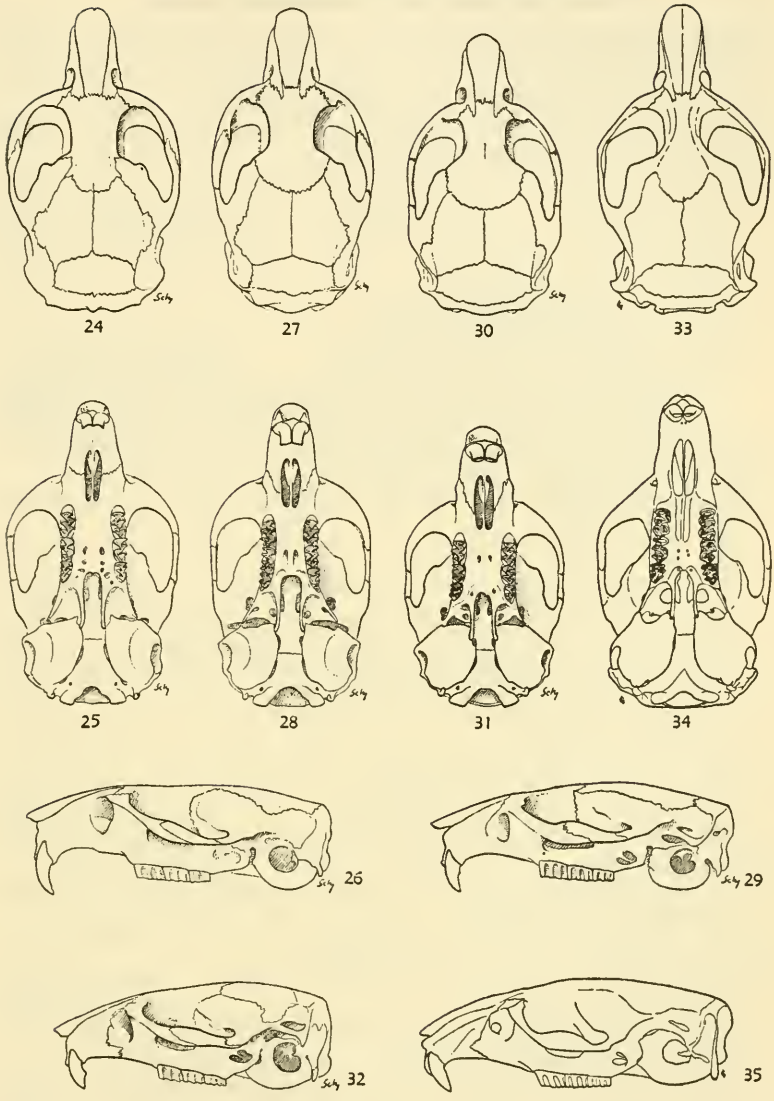


FIG. 22. Distribution of *Phenacomys silvicola*, dusky tree mouse.

drin (A. B. Howell, 1926:34); vicinity Occidental (Hooper, 1944:61), and then north along coast to point of beginning. See figure 20 on page 396.

FIG. 23. *Phenacomys longicaudus*, 2 mi. E Bridgeville, Humboldt Co., California, December 22, 1930; ♀ 41444 KU. × ½.

Six adult males and five adult females measure: total length, 166 (158-176), 182 (170-187); tail, 67 (60-72), 73 (66-83); hind foot, 20 (19-21), 21 (21-22). Upper parts uniform cinnamon, near ochraceous tawny with many hairs sparingly tipped with black; underparts whitish; tail long, blackish, and well haired. Benson and Borell (1931:226) record one female with three embryos and two other females each associated with two young.



FIGS. 24-35. Skulls of *Phenacomys*. All × 1½.

FIGS. 24-26. *P. intermedius celsus*, Humphreys Basin, 10,800 ft., Fresno Co., California; ♂ 41125 MVZ.

FIGS. 27-29. *P. albipes*, Old Ft. Clatsop, 100 ft., Clatsop Co., Washington; ♀ 94499 MVZ.

FIGS. 30-32. *P. longicaudus*, 1 mi. S Occidental, Sonoma Co., California; ♀ 94761 MVZ.

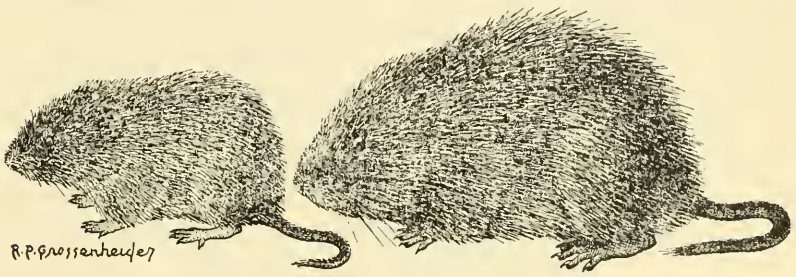
FIGS. 33-35. *P. silvicola*, Netarts, Tillamook Co., Oregon; sex?, 61411 MVZ.

Genus Microtus Schrank—Meadow Mice

1798. *Microtus* Schrank, Fauna Boica . . ., 1 (Abth. 1):72. Type, *Microtus terrestris* Schrank [= *Mus arvalis* Pallas].
1817. *Mynomes* Rafinesque, Amer. Monthly Mag., 2:45. Type, *Mynomes pratensis* Rafinesque [= *Arvicola pennsylvanicus* Ord].
1831. *Pitymys* McMurtrie, Cuvier's Anim. Kingd., American ed., 1:434. Type, *Psammomys pinetorum* LeConte.
1831. *Ammomys* Bonaparte, Saggio Distrib. Metod. Anim. Vert., 20. Type, *Psammomys pinetorum* LeConte.
1836. *Hemiotomys* de Sélys-Longchamps, Essai monograph. sur les Campagnols des environs de Leige, p. 7. Included *fulvus* (= *Mus arvalis* Pallas) and *amphibius* (= *Mus terrestris* Linnaeus [= *Arvicola terrestris* of authors]).
1849. *Neodon* Hodgson, Ann. and Mag. Nat. Hist., 3:203. Type, *Neodon sikimensis* Hodgson.
1857. *Agricola* Blasius, Säugeth. Deutschlands, p. 334. Type, *Mus agrestis* Linnaeus.
1858. *Pedomys* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 517, July 14. Type, *Arvicola austerus* LeConte [= *Hypudaeus ochrogaster* Wagner].
1858. *Chilotus* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 516, July 14. Type, *Arvicola oregoni* Bachman.
1863. *Phaiomys* Blyth, Jour. Asiatic Soc. Bengal, 32, 1:89. Type, *Phaiomys leucurus* Blyth.
1887. *Lasiopodomys* Lataste, Ann. Mus. Civ. Stor. Nat. Genova, 2a, 4:268. Type, *Arvicola brandti* Radde.
1890. *Campicola* Schulze, Schriften Naturw. Vereins d. Harzes in Wernigerode, 5:24. Contained *arvalis* and *agrestis* according to Ellerman and Morrison-Scott, Checklist of Palaearctic and Indian Mammals. . . . British Museum (Nat. History), p. 690, November 19, 1951.
1894. *Tetramerodon* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, p. 282, Oct. 23. Type, *Arvicola tetramerus* Rhoads.
1894. *Aulacomys* Rhoads, Amer. Nat., 28:182, February. Type, *Aulacomys arviculoides* Rhoads.
1898. *Orthriomys* Merriam, Proc. Biol. Soc. Washington, 12:106, April 30. Type, *Microtus umbrosus* Merriam.
1898. *Herpetomys* Merriam, Proc. Biol. Soc. Washington, 12:107, April 30. Type, *Microtus guatemalensis* Merriam.
1899. *Euarvicola* Aeloque, Faune de France, Mamm., p. 49. Type, *Mus agrestis* Linnaeus.
1901. *Stenocranius* Kastschenko, Ann. Mus. St. Petersborg, 6:167. Type, *Microtus slowzowi* Poljakoff.
1908. *Chinomys* Miller, Ann. and Mag. Nat. Hist., 1:97. Type, *Arvicola nivalis* Martins.
1911. *Proedromys* Thomas, Proc. Zool. Soc. London, p. 177. Type *Proedromys bedfordi* Thomas.
1914. *Alexandromys* Ognev, Moskva Dnev. Zool, otd. obsc. liub. jest., 2:109. Type, *Microtus pelliceus* Thomas.
1919. *Abusticola* Shidlovsky, Tiflis Bull. Terr. Exper. Stat., 2:21. Type, *Microtus rubelianus* Shidlovsky [= *Microtus* (*Pitymys*) *majori* Thomas].
1933. *Sumeriomys* Argyropulo, Zeitschr. Säugetier. 8:180. Type, *Mus socialis* Pallas.
1941. *Lemmimicrotus* Tokuda, Biogeog. Tokyo, 4, 1:68. Type, *Arvicola mandarinus* Milne-Edwards.

Total length, 101-261; tail, 15-93; hind foot, 13-30; basal length, 19.3-36.0; zygomatic breadth, 10.7-23.0. Pelage usually long and loose; tail usually less than half as long as head and body, but not excessively reduced; ears short and rounded and nearly concealed

by pelage. Mammae usually 2-2 = 8 (exceptions: 1-1 = 4, *mexicanus* group; 1-2 = 6, subgenus *Pedomys;* 2-0 = 4, subgenus *Orthriomys;* and 2-1 = 6, subgenus *Herpetomys*). Lower incisors with roots extending far behind, and on outer side of, molar series; upper incisors not grooved; molars rootless, with outer and inner re-entrant angles approximately equal; the pattern, a series of loops and triangles of enamel surrounding areas of dentine, varies somewhat with the species.



FIGS. 36-37. Two species of *Microtus,* meadow mice. Both × ½.

FIG. 36. *M. oregoni oregoni,* Reflection Lake, 3900 ft., Jefferson Co., Washington, July 28, 1931; ♂ 10705 KU.

FIG. 37. *M. richardsoni macropus,* 31 mi. N Pinedale, 8025 ft., Sublette Co., Wyoming, July 7, 1951; ♂ 42454 KU.

KEY TO THE SPECIES OF THE GENUS MICROTUS

1. Last lower molar (m3) with 2 transverse loops and 2 median triangles; plantar tubercles 5.
   2. Last upper molar (M3) with 3 triangles; mammae 6; tail less than 46% of total length. . . (Subgenus *Herpetomys*) *M. guatemalensis,* p. 444
   2'. Last upper molar (M3) with 2 closed triangles; mammae 4; tail more than 46% of total length. (Subgenus *Orthriomys*) *M. umbrosus,* p. 445

1'. Last lower molar (m3) with 3 transverse loops and no closed triangles; plantar tubercles 5 or 6.
   3. M3 with 3 closed triangles (except: *M. breweri* with 2 usually confluent; *M. chrotorrhinus* with 5 closed); mammae 8 (except in *M. mexicanus,* which has 4).
      4. Plantar tubercles 5; side glands either on flanks or inconspicuous.
         5. Side glands conspicuous on flanks of adult males; external measurements more than 176, 55, 22. (Subgenus *Aulacomys*) *M. richardsoni,* p. 437
         5'. Side glands obscure or wanting; external measurements less than 176, 55, 22. (Subgenus *Chilotus*) *M. oregoni,* p. 439

4′. Plantar tubercles 6; side glands on hips in adult males (on flanks in *M. xanthognathus*).

6. Skull narrow as in fig. 70 and with pronounced median crest; claws enlarged. . . . . (Subgenus *Stenocranius*).

7. Hind foot more than 21.5; confined to Hall Island and St. Matthew Island in Bering Sea. . . . . *M. abbreviatus*, p. 443

7′. Hind foot less than 21.5; not on Hall and St. Matthew islands but instead on mainland of North America. . . . *M. miurus*, p. 441

6′. Skull not so narrow as in fig. 70 and without pronounced median crest; claws not enlarged. . . . . (Subgenus *Microtus*).

8. M2 with 4 closed angular sections and a rounded posterior loop. . . . . (*M. pennsylvanicus group*).

9. M3 with 2 of the 3 triangles usually confluent; insular species.

10. Interparietal approximately as wide as long; pale (upper parts buffy gray); confined to Muskeget Island, Mass. . . . . *M. breweri*, p. 412

10′. Interparietal notably wider than long; dark (upper parts dark yellowish bister); confined to Great Gull Island and Little Gull Island, New York. . . . . *M. nesophilus*, p. 412

9′. M3 with 3 closed triangles.

11. Nasals truncate posteriorly; confined to Block Island, Rhode Island. *M. provectus*, p. 412

11′. Nasals rounded (not truncate) posteriorly; not on Block Island, Rhode Island. *M. pennsylvanicus*, p. 406

8′. M2 with 4 closed angular sections and no posterior loop (except irregularly in *M. californicus*).

12. Mammae 4 (inguinal, 1-1; pectoral, 1-1); skull short and wide with incisive foramina not constricted (see fig. 83).

13. Colors dull brownish or even grayish above and below; north of Oaxaca. . . . . *M. mexicanus*, p. 431

13′. Colors bright rich brown above and below; known only from Oaxaca. . . . *M. fulviventer*, p. 434

12′. Mammae 8 (inguinal, 2-2; pectoral, 2-2). Skull short or wide with foramina constricted or unconstricted (see figures of skulls).

14. m1 with 4 closed triangles (5 in some *M. o. sitkensis*) and rounded anterior loop. *M. oeconomus*, p. 423

14′. m1 with 5 or 6 closed triangles.

15. A pair of glands on flanks of males; nose yellowish.

16. Hind foot more than 23.5; side glands conspicuous in adult males; M3 with 3 closed triangles. . . . . *M. xanthognathus*, p. 434

16′. Hind foot less than 23.5; glands obscure or wanting; M3 with 5 closed triangles . . . . . *M. chrotorrhinus*, p. 435

15′. A pair of glands on hips of males; nose not yellowish.
17. Incisive foramina gradually tapered posteriorly (not abruptly constricted) or not constricted posteriorly (see figs. 79 and 82).
18. Back always less grayish (usually more reddish) than sides; tail averaging ⅓ or more of total length; skull without prominent ridging and with incisive foramina open and not constricted posteriorly, or if constricted only gradually tapered (see fig. 82); not confined to Oregon and California and not in Baja California.
19. On Forester, Coronation and Warren islands of SE Alaska ..... *M. coronarius*, p. 431
19′. Not on Forester, Coronation and Warren islands of SE Alaska ..... *M. longicaudus*, p. 426
18′. Back never more grayish than sides (frequently less so); tail averaging less than ⅓ of total length; skull prominently ridged and with incisive foramina wide open and not constricted posteriorly (see fig. 79); confined to Oregon, California and Baja California. *M. californicus*, p. 417
17′. Incisive foramina abruptly constricted and narrower posteriorly than anteriorly (see figs. 78 and 80).
20. Confined to Pacific costal area west of crest of Cascade Mts., from Fraser River of extreme SW British Columbia south to 40° lat. in California; upper parts dark brown to blackish; hind foot more than 23.7 ... *M. townsendii*, p. 421
20′. Not confined to Pacific coastal area, but *in the region occupied by M. townsendii* upper parts yellowish or grayish and hind foot less than 23.7 ..... *M. montanus*, p. 413
3′. M3 with 2 closed triangles; mammae 4 or 6.
21. Mammae 4; fur short, fine, molelike, reddish on upper parts; tail less than 26 mm. (Subgenus *Pitymys*).
22. Hind foot of adults less than 16; upper parts pale (near tawny); geographical range Florida and extreme southern Georgia ..... *M. parvulus*, p. 451
22′. Hind foot of adults more than 16; upper parts dark (russet brown or darker); geographical range not including Florida and extreme southern Georgia.
23. Ear from notch usually more than 12.5; upper parts dark (near dark umber); occurs in mountains of eastern Mexico ..... *M. quasiater*, p. 451
23′. Ear from notch usually less than 12.5; upper parts pale (bright russet brown to brownish chestnut); occurs in eastern and central North America north of Mexico. *M. pinetorum*, p. 448
21′. Mammae 6; fur long, coarse, mouselike, grayish as opposed to reddish on upper parts; tail more than 26 mm. in areas where subgenera *Pitymys* and *Pedomys* occur together (Subgenus *Pedomys*).
24. Occurs in southeastern Texas and Louisiana. *M. ludovicianus*, p. 448
24′. Occurs north of Louisiana ..... *M. ochrogaster*, p. 445

Subgenus MICROTUS Schrank

1798. *Microtus* Schrank, Fauna Boica, 1(1):72. Type, *Microtus terrestris* Schrank [= *Mus arvalis* Pallas].

Plantar tubercles 6; lateral glands on hips in adult males; m1 with 5 closed triangles; m3 with 3 transverse loops and no triangles; M2 with 4 closed sections, and in most eastern species an additional posterior inner loop; M3 with 3 closed triangles (except in *M. chrotorrhinus*).

Microtus pennsylvanicus

Pennsylvanian Meadow Mouse

Total length, 140-195; tail, 33-64, hindfoot, 18-24; ear, 12-16. Body 2.0 to 3.1 times as long as tail; tail 1.9 to 2.7 times as long as hind foot. Color of pelage varies according to subspecies; in general, upper parts varying from bright yellowish chestnut to dull bister that is much obscured by black-tipped hairs; northern subspecies generally reddish and southern subspecies generally more blackish or grayish; underparts usually some shade of gray washed with whitish or buffy. Middle upper incisor with fifth posterior loop; incisive foramina long and not constricted posteriorly; Ellerman (1941:590) indicated that this species and the Old World *M. agrestis* are closely related; in fact Ellerman and Morrison-Scott (1951:702) suggest that *M. agrestis* and *M. pennsylvanicus* are conspecific when they state that *M. agrestis* occurs "Doubtless also in much of North America."

Microtus pennsylvanicus has the largest geographic range in North America of any species of the subgenus *Microtus,* and for that matter it has the largest geographic range of any species in the genus *Microtus.* Like most, and probably all, of the species of microtine rodents, *Microtus pennsylvanicus* fluctuates markedly in numbers.

Microtus pennsylvanicus acadicus Bangs.

1897. *Microtus pennsylvanicus acadicus* Bangs, Amer. Nat., 31:239, March, type from Digby, Nova Scotia.

Marginal records (Rand, 1943:117).—Nova Scotia: Victoria County; Guysborough County; Shelburne Co. New Brunswick: Grand Manan. Nova Scotia: Kings Co. Prince Edward Island: Mt. Herbert.

Microtus pennsylvanicus admiraltiae Heller.

1909. *Microtus admiraltiae* Heller, Univ. California Publ. Zool., 5:256, February 18, type from Windfall Harbor, Admiralty Island, Alaska.
1933. *Microtus pennsylvanicus admiraltiae,* Swarth, Proc. Biol. Soc. Washington, 46:208, October 26.

Marginal records (Dale, 1940:340).—Alaska: *Hawk Inlet;* type locality; *Mole Harbor; Lake west of Mole Harbor.*

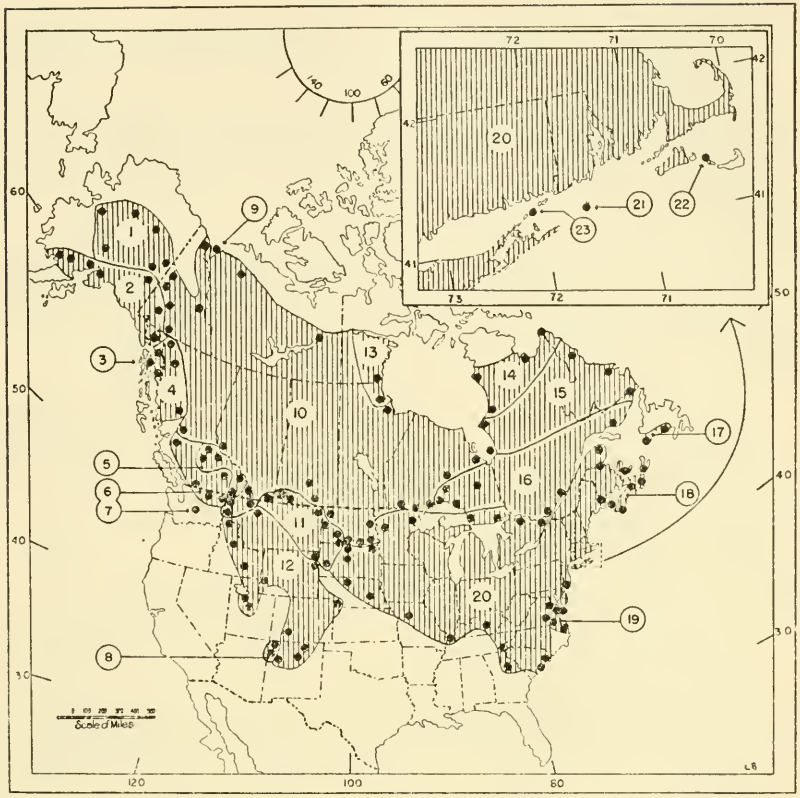


Fig. 38. Distribution of *Microtus pennsylvanicus* and allied species.

Guide to kinds

1. *M. p. tananensis*
2. *M. p. alcorni*
3. *M. p. admiraltiae*
4. *M. p. rubidus*
5. *M. p. microcephalus*
6. *M. p. funebris*
7. *M. p. kincaidi*
8. *M. p. aztecus*
9. *M. p. arcticus*
10. *M. p. drummondii*
11. *M. p. insperatus*
12. *M. p. modestus*
13. *M. p. aphorodemus*
14. *M. p. labradorius*
15. *M. p. enixus*
16. *M. p. fontigenus*
17. *M. p. terraenovae*
18. *M. p. acadicus*
19. *M. p. nigrans*
20. *M. p. pennsylvanicus*
21. *M. provectus*
22. *M. breweri*
23. *M. nesophilus*

Microtus pennsylvanicus alcorni Baker.

1951. *Microtus pennsylvanicus alcorni* Baker, Univ. Kansas Publ., Mus. Nat. Hist., 5:105, November 28, type from 6 mi. SW Kluane, 2550 ft., Yukon.

Marginal records (Baker, 1951:106, unless otherwise specified).—Alaska: E side Deadman Lake, 1800 ft., 15 mi. SE Northway. Yukon: type locality. Alaska: E side Chilkat River, 100 ft., 9 mi. W, 4 mi. N Haines; *Nushagak* (177788 USBS); Kakhtul River, near jct. with Malchatna; Tyonek, Cook Inlet; 1 mi. NE Anchorage, 100 ft.

Microtus pennsylvanicus aphorodemus Preble.

1902. *Microtus aphorodemus* Preble, N. Amer. Fauna, 22:52, October 31, type from Barren grounds about 50 mi. S Cape Eskimo, near mouth Thlewiaza River, District of Keewatin.
1937. *Microtus pennsylvanicus aphorodemus* Anderson, in Canada's Western Northland (Mammals), Dept. Interior, Ottawa, p. 112, July 9.

Marginal records.—Keewatin District: type locality. Manitoba: Churchill (Anderson, 1947:155).

Microtus pennsylvanicus arcticus Cowan.

1951. *Microtus pennsylvanicus arcticus* Cowan, Jour. Mamm., 32:353, August 23, type from Kidluit Bay, northeast corner of Richards Island, 133° 49′ west longitude and 69° 31′ north latitude, Northwest Territories. Known from type locality only.

Microtus pennsylvanicus aztecus (J. A. Allen).

1893. *Arvicola (Mynomes) aztecus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 5:73, April 28, type from Aztec, 5900 ft., San Juan Co., New Mexico.
1952. *Microtus pennsylvanicus aztecus,* Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:307, November 17.

Marginal records (Bailey, 1932:203).—New Mexico: Laplata; *type locality;* Farmington; *Fruitland.*

Microtus pennsylvanicus drummondii (Audubon and Bachman).

1853. *Arvicola drummondii* Audubon and Bachman, Quadrupeds, N. Amer., 3:166, type from "Valleys of the Rocky Mountains"; probably in the vicinity of Jasper House, Alberta.
1913. *Microtus pennsylvanicus drummondii,* Hollister, Canadian Alp. Jour., Special number, p. 23, February 17.
1899. *Microtus stonei* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 12:5, March 4, type from Liard River, British Columbia. See J. A. Allen, Bull. Amer. Mus. Nat. Hist., 19:550, who points out valid characters of this subspecies.

Marginal records.—Mackenzie District: Reindeer Station (Banfield, 1951: 119); Fort Anderson (Bailey, 1900:23); Clinton-Colden Lake (Banfield, 1951:119). Manitoba: Herchmer (Rand, 1943:121). Ontario: Fort Albany (*ibid.*); Lake Attawapiskat (*ibid.*); Thunder Bay (*ibid.*); Quetico Park (Cahn, 1937:27); Rainy River (Anderson, 1947:155). North Dakota: Portland (Bailey, 1900:24); Lisbon (*ibid.*); Ludden (Bailey, 1927:93); Napoleon (*ibid.*); Lostwood (*ibid.*). Saskatchewan: Big Muddy Lake (Rand, 1943:121); Lost Mountain (Rand, 1943:120). Montana: St. Mary Lake (Bailey, 1918:63). Idaho (Davis, 1939:316): 5 mi. W Cocolalla; Priest Lake. British Columbia: Crows Nest Station, on Canadian Pacific Railroad, 4444 ft. (Dale, 1940:337). Alberta: 50 mi. N Jasper House (Bailey, 1900:23). British Columbia: Wistaria (Rand, 1943:121). Yukon: Caribou Crossing (Bailey, 1900:23); Fort Selkirk (*ibid.*); Sixty-mile Creek (*ibid*); Chandindu River (*ibid.*); South Fork, Macmillan River (Rand, 1945:42). Mackenzie District: *Aklavik* (Cowan, 1951:353).

Microtus pennsylvanicus enixus Bangs.

1896. *Microtus enixus* Bangs, Amer. Nat., 30:1051, December, type from Hamilton Inlet, Labrador.
1936. *M[icrotus]. p[ennsylvanicus]. enixus,* D. L. Davis, Jour. Mamm., 17:290, August 14.

Marginal records (Rand, 1943:118, unless otherwise noted).—Labrador: Hebron; type locality; Black Bay (Davis, 1936:291). Quebec: Charlton Island; near Cape Jones.

Microtus pennsylvanicus fontigenus Bangs.

1896. *Microtus fontigenus* Bangs, Proc. Biol. Soc. Washington, 10:48, March 9, type from Lake Edward, Quebec. (Regarded as inseparable from *M. p. pennsylvanicus* by Weaver, Jour. Mamm., 21:420, November 14, 1940, but admitted as valid by Rand, Canadian Field-Nat., 57:119, January 24, 1944).
1897. *Microtus pennsylvanicus fontigenus*, Miller, Proc. Boston Soc. Nat. Hist., 28:14, April 30.

Marginal records.—Quebec (Rand, 1943:119): Natashkwan; near Quebec City; Labelle County. Ontario: Rossport (Saunders, 1932:298); Nipigon (Miller, 1897:14); Macdiarmid (Snyder, 1928:245); Kapuskasing (Rand, 1943:119).

Microtus pennsylvanicus funebris Dale.

1940. *Microtus pennsylvanicus funebris* Dale, Jour. Mamm., 21:338, August 14, type from Coldstream, 1450 ft., 3½ mi. SE Vernon, British Columbia.

Marginal records.—British Columbia (Dale, 1940:338): Island in Anahim Lake; Okanagan Landing. Washington (Dalquest, 1948:346): Newport; Conconully. British Columbia: Princeton (Anderson, 1947:156). Anderson (*ibid.*) synonymized *M. p. funebris* under *M. p. modestus*, probably on the basis of Rand (1943:123).

Microtus pennsylvanicus insperatus (J. A. Allen).

1894. *Arvicola insperatus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:347, December 7, type from Custer, Custer Co., South Dakota.
1943. *Microtus pennsylvanicus insperatus*, Anderson, Canadian Field-Nat., 57:92, October 17.
1920. *Microtus pennsylvanicus wahema* Bailey, Jour. Mamm., 1:72, March 2, type from Glendive, Dawson Co., Montana.

Marginal records.—Saskatchewan (Rand, 1943:122); Crane Lake; Swift Current. Montana: 3 mi. S Medicine Lake City (27781 KU). North Dakota (Bailey, 1927:94): 10 mi. S Williston; Bismark; mouth Cannonball River. South Dakota: type locality. Wyoming: 3 mi. NW Sundance (20620 KU). Alberta: Milk River (Rand, 1943:122).

Microtus pennsylvanicus kincaidi Dalquest.

1941. *Microtus montanus kincaidi* Dalquest, Proc. Biol. Soc. Washington, 54:145, September 30, type from the Potholes, 10 mi. S Moses Lake, Grant Co., Washington. Known only from type locality and *Moses Lake*.
1948. *Microtus pennsylvanicus kincaidi* Dalquest, Univ. Kansas Publ., Mus. Nat. Hist., 2:347, April 9.

Microtus pennsylvanicus labradorius Bailey.

1898. *Microtus pennsylvanicus labradorius* Bailey, Proc. Biol. Soc. Washington, 12:88, April 30, type from Fort Chimo, Quebec.

Marginal records (Rand, 1943:119).—Quebec: Port Burwell; Great Whale River; Port Harrison; mouth Koksoak River.

Microtus pennsylvanicus microcephalus (Rhoads).

1894. *Arvicola (Mynomes) microcephalus* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 46:286, October 23, type from Lac LaHache, British Columbia.
1940. *Microtus pennsylvanicus microcephalus*, Dale, Jour. Mamm., 21:337, August 14.

Marginal records (Dale, 1940:338).—British Columbia: Cottonwood P. O.; Mt. Robson, Mt. Robson Park; Field; Cranbrook; type locality.

Microtus pennsylvanicus modestus (Baird).

1858. *Arvicola modesta* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 535, July 14, type from Cochetopa ("Sawatch") Pass, Saguache Co., Colorado.
1900. *Microtus pennsylvanicus modestus* Bailey, N. Amer. Fauna, 17:20, June 6.

Marginal records.—Montana: Blackfoot (Bailey, 1900:21). Wyoming: Newcastle (*ibid.*). Nebraska: Haigler (110801 USBS). New Mexico: near Cimarron (Hill, 1942:81); [Coyote Creek, east side] Sangre de Cristo Mts. (Bailey, 1932:200); San Raphael, near eastern point of Zuni Mts. (*ibid.*). Colorado: Tevebaughs Ranch, 9 mi. S Cochetopa Pass (Cary, 1911:121). Wyoming: Cokeville (177010 USBS). Utah: 2 mi. S Provo (2867 Brigham Young Univ.); ½ mi. W Salt Lake Airport, U. S. Highway 40, 4200 ft. (Durrant, 1952:363). Idaho (Davis, 1939:316): Bannock Creek, 4 mi. S Portneuf River; Challis; Coeur d'Alene.

Microtus pennsylvanicus nigrans Rhoads.

1897. *Microtus pennsylvanicus nigrans* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 49:307, June 18, type from Currituck, Currituck Co., North Carolina.

Marginal records.—Virginia: Richmond County (Handley and Patton, 1947:174); Smiths Island (Bailey, 1900:19). North Carolina: type locality. Virginia: Nansemond County (Handley and Patton, 1947:173).

Microtus pennsylvanicus pennsylvanicus (Ord).

1815. *Mus Pennsylvanica* Ord, Guthrie's Geography, 2nd Amer. ed., 2:292, type from meadows below Philadelphia, Pennsylvania.
1895. *M[icrotus]. pennsylvanicus*, Rhoads, Amer. Nat., 29:940, October.
1817. *Mynomes pratensis* Rafinesque, Amer. Monthly Mag., 2:45, based on Wilson's (Amer. Orn., 6:pl. 50, fig. 3) description of the meadow mouse from meadows below Philadelphia and along the seashore.
1820. *Lemmus noveboracensis* Rafinesque, Annals of Nature, p. 3, type from New York or New Jersey.
1825. *Arvicola riparius* Ord, Jour. Acad. Nat. Sci. Philadelphia, 4(2):305-306, type locality not given.
1825. *Arvicola palustris* Harlan, Fauna Americana, pp. 136, type from swamps along the shores of the Delaware.
1840. *Arvicola hirsutus* Emmons, Rept. Quad. Massachusetts, p. 60, type locality, Massachusetts.
1840. *Arvicola alborufescens* Emmons, Rept. Quad. Massachusetts, p. 60, type from Williamstown, Massachusetts.
1841. *Arvicola fulva* Audubon and Bachman, Proc. Acad. Nat. Sci., Philadelphia, 1:96, type from "One of the Western States; we believe Illinois."
1841. *Arvicola nasuta* Audubon and Bachman, Proc. Acad. Nat. Sci. Philadelphia, 1:96-97, type from near Boston, Massachusetts.

1842. *Arvicola rufescens* DeKay, Zool. New York, Mammals, 1:85, type from Oneida Lake, New York.
1842. *Arvicola oneida* DeKay, Zool. New York, Mammals, 1:88-89, type from Oneida Lake, New York.
1854. *Arvicola dekayi* Audubon and Bachman, Quad. N. Amer., 3:287-288, type from New York or Illinois.
1858. *Arvicola riparia* var. *longipilis* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 524, July 14, type from West Northfield, Illinois, or Racine, Wisconsin.
1858. *Arvicola rufidorsum* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 526, July 14, type from Holmes Hole, Marthas Vineyard, Massachusetts.
1901. *Microtus pennsilvanicus [sic] shattucki* Howe, Proc. Portland Soc. Nat. Hist., 2:201, December 31, type from Tumble Down Dick Island, near Long Island, Penobscot Bay, Maine. Regarded by Wyman (Jour. Mamm., 3:166, August 4, 1922) as inseparable from *Microtus pennsylvanicus pennsylvanicus.*

Marginal records.—Quebec: Gaspé Peninsula (Rand, 1943:117). New Brunswick: nr. Bathhurst (*ibid.*). Maine: Calais (Bailey, 1900:18); *Tumble Down Dick Island* (Wyman, 1922:164). Mass.: *Woods Hole* (Bailey, 1900:18). New Jersey: Tuckerton (*ibid.*). Virginia (Handley and Patton, 1947:173): Westmoreland County; Prince George County. South Carolina: near Santee River, Charleston Co. (Nelson, 1934:253); Charleston (Penney, 1950:86). Georgia: 2 mi. N Athens (Odum, 1948B:74). North Carolina: Highlands (Odum, 1948A:74). Kentucky (Howell, 1910:29): Lexington; Midway. Missouri: Saline County [presumably] (Enders, 1932:119). Nebraska (Bailey, 1900:18): Blair; Valentine. South Dakota: Pierre (*ibid.*); Swan Creek, 1600 ft., 13 mi. S Selby (37213 KU); Fort Sisseton (Bailey, 1900:18). Minnesota (*ibid.*): Heron Lake; Tower. Ontario (Rand, 1943: 117): Pancake Bay; Nipissing; Algonquin Park. Quebec: Ottawa (*ibid.*).

Microtus pennsylvanicus rubidus Dale.

1940. *Microtus pennsylvanicus rubidus* Dale, Jour. Mamm., 21:339, August 13, type from Sawmill Lake, near Telegraph Creek, British Columbia.

Marginal records (Dale, 1940:339, unless otherwise noted).—British Columbia: Atlin; type locality; Hazelton. Alaska: Fort Wrangell (Bailey, 1900:24, as *M. drummondi;* specimen not examined by us); Taku River.

Microtus pennsylvanicus tananaensis Baker.

1951. *Microtus pennsylvanicus tananaensis* Baker, Univ. Kansas Publ. Mus. Nat. Hist., 5:107, Nov. 28, type from Yerrick Creek, 21 mi. W, 4 mi. N Tok Junction, Alaska.

Marginal records (Baker, 1951:107, unless otherwise indicated).—Alaska: Bettles (43847 KU); near Fort Yukon (p. 108); Eagle; type locality; head of Glacier Creek, Mt. McKinley; Nulato.

Microtus pennsylvanicus terraenovae (Bangs).

1894. *Arvicola terraenovae* Bangs, Proc. Biol. Soc. Washington, 9:129, July 27, type from Codroy, Newfoundland.
1936. *M[icrotus]. p[ennsylvanicus]. terraenovae,* D. L. Davis, Jour. Mamm., 17:290, August 14.

Marginal records.—Newfoundland (Bailey, 1900:25): type locality; Penguin Island.

Microtus provectus Bangs

Block Island Vole

1908. *Microtus provectus* Bangs, Proc. New England Zool. Club, 4:20, March 6, type from Block Island, Newport Co., Rhode Island. Known from type locality only.

Total length, 166-187; tail, 43-54; hind foot, 21.5-23.0. Upper parts yellowish bister, with mixture of dark brown-tipped hairs; venter clear gray, becoming whitish along midventral line, tail indistinctly bicolored, dusky above, grayish below.

This insular species is closely related to *M. p. pennsylvanicus* of the adjacent mainland and is said to differ in having always gray (instead of sometimes gray) underparts and in cranial details as follows: skulls of old adults longer and narrower; nasals truncate (not rounded) posteriorly; interparietal wider and extended farther anteriorly between parietals.

Microtus nesophilus Bailey

Gull Island Vole

1898. *Microtus insularis* Bailey, Proc. Biol. Soc. Washington, 12:86, April 30 (not of Nilsson, 1844), type from Great Gull Island, off eastern extremity of Long Island, Suffolk Co., New York. Known only from type locality and adjacent *Little Gull Island* (Miller, 1899:324).

1898. *Microtus nesophilus* Bailey, Science, n. s., 8:783, December 2 (substitute for *Microtus insularis* Bailey).

Total length, 185; tail, 41; hind foot, 20-21. Upper parts dark yellowish bister heavily mixed with black hairs, darkest on nose and face; venter dusky, washed with cinnamon; tail bicolor, blackish above, dark brown below. This insular species, closely related to *M. pennsylvanicus*, is said to differ as follows: darker pelage; shorter and wider skull; more widely spreading zygomata; deeper prezygomatic notches. This species probably is extinct (see Bailey, 1900:27 and Miller, 1899:324).

Microtus breweri (Baird)

Beach Vole

1858. *Arvicola breweri* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 525, July 14, type from Muskeget Island, off Nantucket, Massachusetts. Known from type locality only.

1896. *Microtus breweri*, Miller, Proc. Boston Soc. Nat. Hist., 27:83, June.

Average and extreme external measurements of 5 males and 8 females: total length, 200.8 (191-211), 186 (176-203); tail, 49.8 (45-58), 47.9 (41-56); hind foot, 23.7 (22.4-25), 23.1 (22-24). Upper parts buffy gray, with scattered brown and black-tipped hairs; sides paler; venter tinged with sulphur yellow; tail bicolor, rusty brown or blackish above, soiled whitish below. This insular

species is closely related to *M. pennsylvanicus* and is said to differ as follows: paler, longer and coarser pelage; anteriorly wider nasals; and longer interparietal.

Microtus montanus

Montane Meadow Mouse

Total length, 140-192; tail, 31-69; hind foot, 18-25; weight, 37.3-85.0 grams. Upper parts some shade of brownish, often with buffy or grayish wash, and with mixture of black-tipped hairs; sides lighter and more buffy; venter white to gray, sometimes washed with buffy; tail bicolor, blackish brown to black above, grayish below. Body 2.4 to 2.8 times as long as tail; tail 2.2 to 2.4 times as long as hind foot. Middle upper molar with four closed triangles; incisive foramina constricted posteriorly. In Nevada the number of embryos in 63 females varied from 2 to 8, usually was 5 or 6, and averaged 6.3.

Microtus montanus amosus Hall and Hayward.

1941. *Microtus montanus amosus* Hall and Hayward, The Great Basin Naturalist, 2:105, July 20, type from Torrey, Wayne Co., Utah.

Marginal records (Durrant, 1952:369).—Vernal, 5300 ft.; Ashley Creek, 2 mi. S Jensen; Steep Creek, Aquarius Plateau; 20 mi. N Escalante, 9500 ft.; Mammoth R. S.; La Point.

Microtus montanus arizonensis Bailey.

1898. *Microtus montanus arizonensis* Bailey, Proc. Biol. Soc. Washington, 12:88, April 30, type from Springerville, Apache Co., Arizona.

Marginal records (Bailey, 1932:200, unless otherwise noted).—New Mexico: Jemez Mts. Arizona: West Fork Black River, 7700 ft. (61294 MVZ); type locality. New Mexico: Nutria.

Microtus montanus canescens Bailey.

1898. *Microtus nanus canescens* Bailey, Proc. Biol. Soc. Washington, 12:87, April 30, type from Conconully, Okanogan Co., Washington.
1938. *Microtus montanus canescens,* Hall, Proc. Biol. Soc. Washington, 51:133, August 28.

Marginal records.—British Columbia (Bailey, 1900:31): Ducks; Vernon. Washington: Molson (Taylor and Shaw, 1929:24); Benton City (Dalquest, 1948:349); Bumping Lake (Taylor and Shaw, 1929:24); Blewett Pass (*ibid.*); type locality. British Columbia: 1 mi. up Trout Creek, Summerland, Okanagan Lake (77464 MVZ).

Microtus montanus canicaudus Miller.

1897. *Microtus canicaudus* Miller, Proc. Biol. Soc. Washington, 11:67, April 21, type from McCoy, Willamette Valley, Polk Co., Oregon.
1951. *Microtus montanus canicaudus,* Hall and Kelson, Univ. Kansas Publ., Mus. Nat. Hist., 5:77, October 1.

Marginal records (Hall and Kelson, 1951:77, unless otherwise noted).—Oregon: Banks (Bailey, 1936:206); Hood River; Wapinitia; Eugene (Bailey, 1936:206); Corvallis; Sheridan.

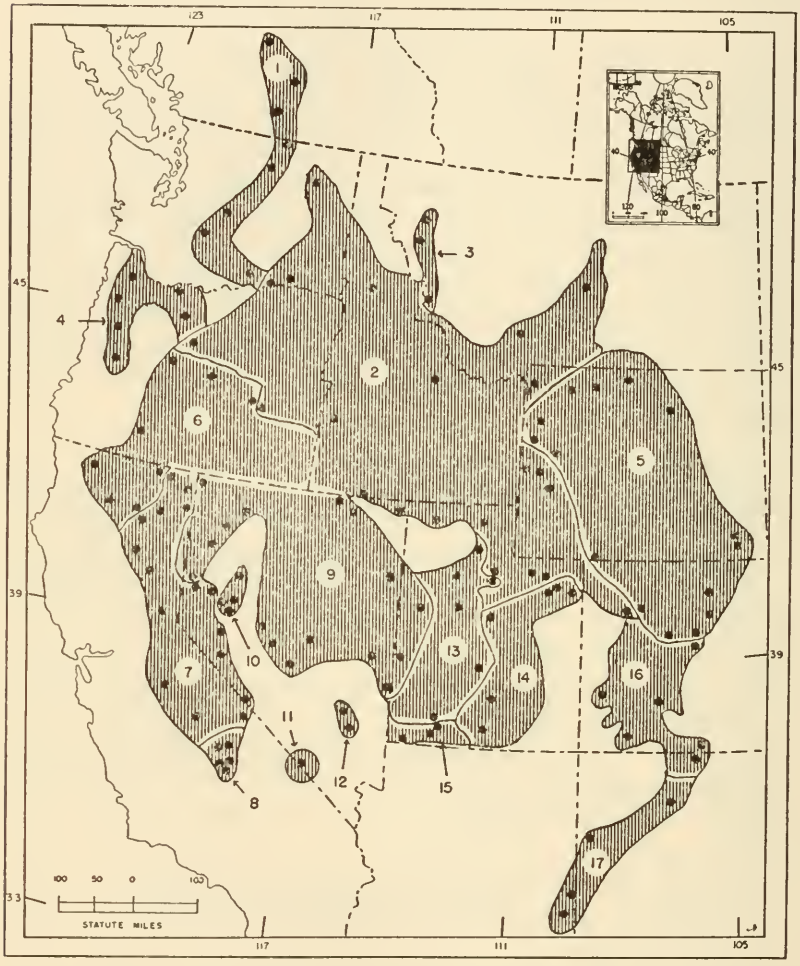


FIG. 39. Distribution of *Microtus montanus*.

Guide to subspecies
1. *M. m. canescens*
2. *M. m. nanus*
3. *M. m. pratincola*
4. *M. m. canicaudus*
5. *M. m. caryi*
6. *M. m. montanus*
7. *M. m. yosemite*
8. *M. m. dutcheri*
9. *M. m. micropus*
10. *M. m. undosus*
11. *M. m. nevadensis*
12. *M. m. fucosus*
13. *M. m. nexus*
14. *M. m. amosus*
15. *M. m. rivularis*
16. *M. m. fusus*
17. *M. m. arizonensis*

MICROTUS MONTANUS CARYI Bailey.

1917. *Microtus montanus caryi* Bailey, Proc. Biol. Soc. Washington, 30:29, February 21, type from Milford, Fremont Co., Wyoming.

Marginal records (After S. Anderson, MS, 1952).—Wyoming: Medicine Wheel Ranch, 9000 ft., 28 mi. E Lovell (32755 KU); 7½ mi. W and 1 mi. S Buffalo, 6500 ft. (27606 KU); Meadow (159774 USBS); 11 mi. N, 5½ mi. E Cheyenne, 5450 ft. (15748 KU). Colorado: 19¾ mi. W, 2½ mi. S Loveland, 7200 ft. (26887 KU); 3 mi. S Ward, 9000 ft. (20650 KU); Grays Peak (1095 KU); Eagle, 10,000 ft. (248244 USBS); 9½ mi. SW Pagoda Peak, 7700 ft. (20647 KU). Wyoming: 32 mi. S, 22 mi. E Rock Springs, 7025 ft. (42284 KU); 34 mi. N, 4 mi. W Pinedale, 7950 ft. (42174 KU); Teton Pass, above Fish Creek (170400 USBS); Moran (17440 KU); Pat O'Hara Creek, NE base Black Mtn. (169250 USBS); 13 mi. N, 1 mi. E Cody, 5200 ft. (37801 KU).

MICROTUS MONTANUS DUTCHERI Bailey.

1898. *Microtus dutcheri* Bailey, Proc. Biol. Soc. Washington, 12:85, April 30, type from Big Cottonwood Meadows, 10,100 ft., SE of Mt. Whitney, Inyo Co., California.
1913. *Microtus montanus dutcheri* Grinnell, Proc. California Acad. Sci., ser. 4, 3:317, August 28.

Marginal records (Grinnell, 1933:186, unless otherwise noted).—California: Cottonwood Lakes, 11,100 ft.; *Little Cottonwood Creek;* Monache Meadows (Kellogg, 1922:268); Jackass Meadow; Jordan Hot Springs, 6700 ft.; Whitney Creek, 10,650 ft.

MICROTUS MONTANUS FUCOSUS Hall.

1935. *Microtus montanus fucosus* Hall, Univ. California Publ. Zool., 40:421, October 25, type from Hiko, 4000 ft., Pahranagat Valley, Lincoln Co., Nevada.

Marginal records (Hall, 1946:549).—Nevada: 3 mi. N Crystal Spring, 4000 ft., Pahranagat Valley; 4 mi. S Alamo, Pahranagat Valley.

MICROTUS MONTANUS FUSUS Hall.

1938. *Microtus montanus fusus* Hall, Proc. Biol. Soc. Washington, 51:133, August 28, type from 2¼ mi. E Cochetopa Pass, Saguache Co., Colorado.

Marginal records.—Colorado: E of Como, South Park (Cary, 1911:124, as *M. nanus*); type locality; 1.6 mi. NE Medano Springs Ranch hdq. (Hall, 1938:132). New Mexico: Forks of Tusas Creek, 8700 ft., San Juan Mts. (Bailey, 1932:198, as *M. nanus nanus*). Colorado: Florida (Hall, 1938: 131); near Coventry (Cary, 1911:124, *as M. nanus*).

MICROTUS MONTANUS MICROPUS Hall.

1935. *Microtus montanus micropus* Hall, Univ. California Publ. Zool., 40:417, October 25, type from Cleveland Ranch, 6000 ft., Spring Valley, White Pine Co., Nevada.

Marginal records (Hall, 1946:545, unless otherwise noted).—Nevada: Barrel Spring, 5700 ft., 9¾ mi. E and 3¾ mi. N Ft. Bidwell; 7 mi. NW Mountain City, Owyhee River; Summit between heads of Copper and Coon creeks, Jarbidge Mts.; Salt Spring, 4200 ft. Utah (Durrant, 1952:368): Fish Springs, 4400 ft.; 5 mi. S Garrison, 5400 ft. Nevada: 3¾ mi. N Eagle Valley, 5600 ft.; Steptoe Creek, 6400 ft.; Fish Spring Valley, 6¾ mi. N Fish Lake, 6000 ft.; Monitor Valley, 9 to 9¾ mi. E Toquima Peak, 7000 ft.; Bells Ranch, 6890 ft.; Campbell Creek Ranch, 5500 ft.; Pine Forest Range;

Flowing Spring, 7 mi. E and 3½ mi. N Division Peak, 4200 ft.; Deep Hole, 4000 ft.; 4¾ mi. S Flanigan, 4200 ft.

Microtus montanus montanus (Peale).

1848. *Arvicola montana* Peale, U. S. Explor. Exp., vol. 8, Mamm. and Ornith., p. 44, type from headwaters of the Sacramento River, near Mt. Shasta, Siskiyou Co., California.
1897. [*Microtus*] *montanus*, Trouessart, Catal. Mamm. viv. et foss., p. 563.
1858. *Arvicola longirostris* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 531, July 14, type perhaps from upper Pit River, California (see Kellogg, 1922, Univ. California Publ. Zool., 21:263-264).

Marginal records.—Oregon: Sisters (204691 USBS); 2 mi. SW Barnes (31599 MVZ); 5 mi. NNE Burns (79450 MVZ); Malheur Lake (Bailey, 1936:202). California: E side Tule Lake (Grinnell, 1933:185); Fort Crook (*ibid.*); Dale Meadows, Mt. Eddy (65499 MVZ); Stud Horse Canyon, Siskiyou Mts. (Grinnell, 1933:185). Oregon: Fort Klamath (Bailey, 1900:29).

Microtus montanus nanus (Merriam).

1891. *Arvicola* (*Mynomes*) *nanus* Merriam, N. Amer. Fauna, 5:63, July 30, type from Pahsimeroi Mts., head of Pahsimeroi River, 9350 ft., Custer Co., Idaho.
1938. *Microtus montanus nanus*, Hall, Proc. Biol. Soc. Washington, 51:133, August 23.

Marginal records.—Washington: Gifford (236195 USBS). Idaho: 2 mi. NE Weippe, 3000 ft. (Davis, 1939:318); type locality. Montana: west fork of West Fork, Gallatin River (Hall and Kelson, 1951:77); Big Snowy Mts. (*ibid.*). Wyoming (after S. Anderson, MS, 1952): Canyon Camp, Yellowstone Nat'l Park (248640 USBS); Lower Geyser Basin, Yellowstone Nat'l Park (126419 USBS); 13 mi. N, 2 mi. W Afton (37809 KU); Horse Creek, 7800 ft., Merna (176880 USBS); Big Piney (147188 USBS). Colorado: White River, east of Meeker (Cary, 1911:124). Utah (Durrant, 1952:365): Henrys Park, Henrys Fork; Bald Mt., 25 mi. NE Kamas; 5 mi. E Park City; Anderson Ranch, Blacksmith Fork, 5500 ft.; *Logan;* Kelton, 4225 ft. Nevada: Goose Cr., 5000 ft., 2 mi. W Utah boundary (Hall, 1946:546). Idaho (Hall and Kelson, 1951:77); Three Creek, Owyhee Co., Nampa. Oregon (Bailey, 1936:204): ridge N of Crane; Hay Creek. Washington: 5 mi. E Wallula (Dalquest, 1948:349); Prescott (*op. cit.*:348).

Microtus montanus nevadensis Bailey.

1898. *Microtus nevadensis* Bailey, Proc. Biol. Soc. Washington, 12:86, April 30, type from Ash Meadows, Nye Co., Nevada. Known only from type locality and 3½ mi. N thereof (see Hall, Mammals of Nevada, Univ. California Press, p. 549, July 1, 1946).
1935. *Microtus montanus nevadensis*, Hall, Univ. California Publ. Zool., 40:423, October 25.

Microtus montanus nexus Hall and Hayward.

1941. *Microtus montanus nexus* Hall and Hayward, The Great Basin Naturalist, 2:106, July 20, type from West Canyon, Oquirrh Range, Utah Co., Utah.

Marginal records (Durrant, 1952:367, unless otherwise noted).—Utah: Ogden; 4 mi. NE Snyderville, 5600 ft. (Kelson, 1951:98); 10 mi. N Fish Lake,

Fishlake Mts., 10,000 ft.; Cedar Breaks Nat'l Monument (p. 370); Little Valley, Sheeprock Mts., 5500 ft.; Tooele.

Microtus montanus pratincola Hall and Kelson.

1951. *Microtus montanus pratincolus* Hall and Kelson, Univ. Kansas Publ., Mus. Nat. Hist., 5:75, October 1, type from 6 mi. E Hamilton, 3700 ft., Ravalli Co., Montana.

Marginal records (Hall and Kelson, 1951:76-77).—Montana: end of W arm Flathead Lake; Canyon Creek; Hotsprings Creek.

Microtus montanus rivularis Bailey.

1898. *Microtus nevadensis rivularis* Bailey, Proc. Biol. Soc. Washington, 12:87, April 30, type from St. George, Washington Co., Utah.
1900. *Microtus montanus rivularis* Bailey, N. Amer. Fauna, 17:29, June 6.

Marginal records (Durrant, 1952:370).—Utah: Duck Creek, 8500 ft.; Blue Springs, Zion Nat'l Park, type locality.

Microtus montanus undosus Hall.

1935. *Microtus montanus undosus* Hall, Univ. California Publ. Zool., 40: 420, October 25, type from Lovelock, Pershing Co., Nevada.

Marginal records (Hall, 1946:548).—Nevada: type locality; Stillwater; 10 mi. SSE Fallon; 4 mi. W Fallon.

Microtus montanus yosemite Grinnell.

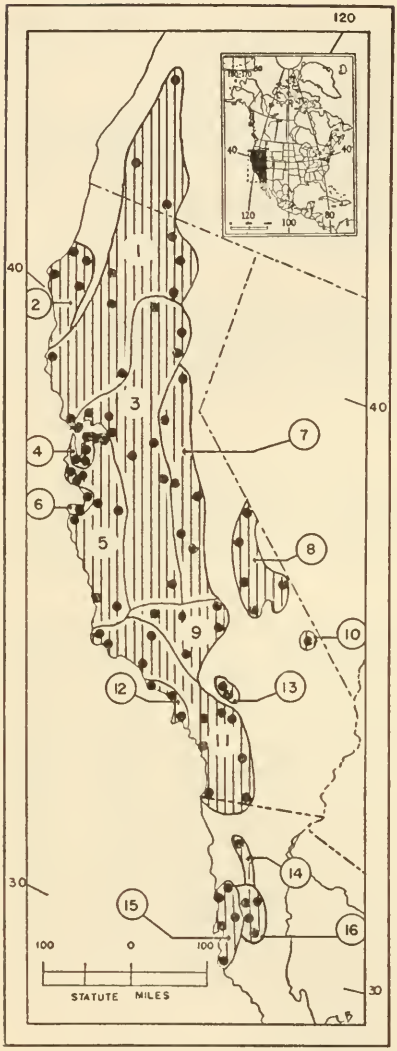
1914. *Microtus montanus yosemite* Grinnell, Proc. Biol. Soc. Washington, 27:207, October 31, type from Yosemite Valley, 4000 ft., Mariposa Co., California.

Marginal records.—California: Steel Meadow, 4700 ft. (32982 MVZ); Goose Lake [Davis Creek] (Grinnell, 1933:186); southern end of Middle Lake (Mailliard, 1925:105). Nevada (Hall, 1946:547): Pyramid Lake, 2 mi. W Sutcliffe; 2½ mi. W Hazen; Schurz Indian dam, Walker River, 4300 ft.; N fork Cat Creek, 8800 ft., Mt. Grant; Fish Lake, 4800 ft. California: Deep Spring Lake, 5000 ft. (77728 MVZ); Shaver Ranger Station, 5300 ft. (36824 MVZ); Gentry's, Big Oak Flat Road, 5800 ft. (Kellogg, 1922:265); Cisco (19309 MVZ); Buck's Ranch, 5100 ft. (Kellogg, 1922: 264); Battle Creek Meadows (Grinnell, Dixon, and Linsdale, 1930:522); Cassel, 3000 ft. (Grinnell, 1933:186); Bieber (Kellogg, 1922:265).

Microtus californicus

California Meadow Mouse

Total length, 157-211; tail, 39-68; hind foot, 20-25. Upper parts varies from tawny olive through cinnamon brown, with mixture of long, dark overhairs that vary from light seal brown to black; sides lighter, with fewer long overhairs; venter neutral gray, often with white-tipped hairs; tail bicolor, clove brown to black above, grayish below. Body 2.0-2.5 times as long as tail; tail 2.3-2.6 times as long as hind foot; 4 closed triangles in M2; incisive foramina are not constricted posteriorly but rounded at both ends and widest in middle.



Donald M. Hatfield's study (Jour. Mamm., 16:261-271, November 15, 1935) revealed that this species has three distinct pelages: juvenal, by the fifth day; post-juvenal, by the third week; and adult by the eighth or ninth week. He was the first to learn that there is a regular pattern of molt in the post-juvenal and juvenal growth of hair but that the progress of molt in the adult pelage is spotty and irregular—a phenomenon now known to characterize most, or all, microtine rodents.

The young are born blind, deaf, hairless (except that the facial vibrissae are in evidence), pink, and weigh 2.3 to 3.1 grams. The eyes open on the tenth day, the ears function on the seventh or eighth day, pigment in the skin begins to appear in the eighth hour after birth, and adults average 53 grams in weight. Females breed when they weigh only 21 grams at 21 to 22 days of age, but males first breed at six weeks of age. The gestation period is approximately 21 days.

FIG. 40. Distribution of *Microtus californicus*.

Guide to subspecies

1. *M. c. eximius*
2. *M. c. constrictus*
3. *M. c. aestuarinus*
4. *M. c. paludicola*
5. *M. c. californicus*
6. *M. c. halophilus*
7. *M. c. mariposae*
8. *M. c. vallicola*
9. *M. c. kernensis*
10. *M. c. scirpensis*
11. *M. c. sanctidiegi*
12. *M. c. stephensi*
13. *M. c. mohavensis*
14. *M. c. grinnelli*
15. *M. c. aequivocatus*
16. *M. c. huperuthrus*

MICROTUS CALIFORNICUS AEQUIVOCATUS Osgood.

1928. *Microtus californicus aequivocatus* Osgood, Jour. Mamm., 9:56, February 9, type from San Quintin, Baja California.

Marginal records.—Baja California: San José (Huey, 1931:49); San Antonio (Grinnell, 1926:225); 1 mi. E El Rosario (Huey, 1931:49); type locality; San Telmo (Grinnell, 1926:225). Records by Grinnell (*supra*) were published under the name *M. c. huperuthus.*

Microtus californicus aestuarinus R. Kellogg.

1918. *Microtus californicus aestuarinus* R. Kellogg, Univ. California Publ. Zool., 21:15, December 28, type from Grizzly Island, Solano Co., California.

Marginal records (Kellogg, 1918:15, unless otherwise noted).—California: Mill Creek, 2 mi. NE Tehama; Chico (Grinnell, 1933:187); Chambers Ravine, 4 mi. N Oroville; Tracy Lake, 6 mi. SW Galt; La Grange; Tulare Lake basin (Grinnell, 1933:187); Tracy; type locality; Bolinas; Petaluma (Grinnell, 1933:187); Cordelia.

Microtus californicus californicus (Peale).

1848. *Arvicola californica* Peale, U. S. Explor. Exp., vol. 8, Mamm. and Ornith., p. 46, type from vicinity of San Francisco Bay, California; probably at San Francisquito Creek, near Palo Alto, Santa Clara Co.
1897. [*Microtus*] *californicus*, Trouessart, Catal. Mamm. viv. et foss., p. 563.
1853. *Arvicola edax* LeConte, Proc. Acad. Nat. Sci. Philadelphia, 6:405, type from California, south of San Francisco. Probably Monterey according to R. Kellogg, Univ. California Publ., 21:18, December 28, 1918.
1858. *Arvicola trowbridgii* Baird, Repts. Expl. and Surv. . . ., pt. 1 Mammals, p. 529, July 14, type from Monterey, California.

Marginal records (Kellogg, 1918:5, unless otherwise noted).—California: Walnut Creek; slopes of Mt. Diablo (Grinnell, 1933:186); Sweeney's Ranch, 22 mi. S Las Baños (*ibid.*); Morro (Bailey, 1900:35); Monterey; Salinas Valley; Boulder Creek (Bailey, 1900:35); Pescadero; Black Mtn.

Microtus californicus constrictus Bailey.

1900. *Microtus californicus constrictus* Bailey, N. Amer. Fauna, 17:36, June 6, type from Cape Mendocino, Humboldt Co., California.

Marginal records (Grinnell, 1933:187).—California: Eureka; Fair Oaks; Cuddeback; Capetown.

Microtus californicus eximius R. Kellogg.

1918. *Microtus californicus eximius* R. Kellogg, Univ. California Publ. Zool., 21:12, December 28, type from Lierly's Ranch, 2340 ft., 4 mi. S Mt. Sanhedrin, Mendocino Co., California.

Marginal records (Kellogg, 1918:12, unless otherwise noted).—Oregon (Bailey, 1900:35): Drain; Siskiyou. California: Mayten (Grinnell, 1933:187); Cassel (Bailey, 1900:35); Turner's (Grinnell, 1933:187); 2 mi. S South Yollo Bolly Mtn.; Rumsey (Grinnell, 1933:187); Olema (*ibid.*); Mendocino City; Helena. Oregon: Rogue River Valley near Grants Pass (Bailey, 1900:35; this and other records here ascribed to Bailey were recorded by him under the name *M. californicus* in the trinomial sense).

Microtus californicus grinnelli Huey.

1931. *Microtus californicus grinnelli* Huey, Trans. San Diego Soc. Nat. Hist., 7:47, December 19, type from Sangre de Cristo in Valle San Rafel on W base Sierra Juárez, Baja California, lat. 31° 52′ N, long. 116° 06′ W. Known from the type locality only.

MICROTUS CALIFORNICUS HALOPHILUS vonBloeker.

1937. *Microtus californicus halophilus* vonBloeker, Proc. Biol. Soc. Washington, 50:156, September 10, type from Moss Landing, Monterey Co., California.

Marginal records (vonBloeker, 1937:157).—California: mouth of Elkhorn Slough; Seaside.

MICROTUS CALIFORNICUS HUPERUTHRUS Elliot.

1903. *Microtus californicus huperuthrus* Elliot, Field Columb. Mus., Publ. 74, zool. ser., 3:161, May 7, type from La Grulla, San Pedro Mártir Mts., Baja California (see Elliot, Field Columb. Mus., publ. 115, zool. ser. 8:292, March 4, 1907).
1926. *Microtus californicus perplexabilis* Grinnell, Jour. Mamm., 7:223, August 9, type from La Grulla, 7000 ft., Sierra San Pedro Mártir, Baja California.
1903. *Microtus californicus hyperythrus* Elliot, Field Columb. Mus. Publ. 79, zool. ser. 3:218, August 15. This was a change of transliteration.

Marginal records (Grinnell, 1926:225).—Baja California: Concepción; Vallecitos; San Ramon; type locality.

MICROTUS CALIFORNICUS KERNENSIS R. Kellogg.

1918. *Microtus californicus kernensis* R. Kellogg, Univ. California Publ. Zool., 21:26, December 28, type from Fay Creek, 4100 ft., Kern Co., California.

Marginal records.—California: Taylor Meadow (Grinnell, 1933:188); Onyx (Kellogg, 1918:27); Fort Tejon (Grinnell, 1933:188); Buena Vista Lake (*ibid.*); Bakersfield (Kellogg, 1918:27).

MICROTUS CALIFORNICUS MARIPOSAE R. Kellogg.

1918. *Microtus californicus mariposae* R. Kellogg, Univ. California Publ. Zool., 21:19, December 28, type from 1¾ mi. W El Portal, 1800 ft., Mariposa Co., California.

Marginal records (Kellogg, 1918:19, unless otherwise noted).—California: Dutch Flat (Grinnell, 1933:188); type locality; Minkler (Grinnell, 1933: 188); Clovis; Pleasant Valley; Carbondale.

MICROTUS CALIFORNICUS MOHAVENSIS R. Kellogg.

1918. *Microtus californicus mohavensis* R. Kellogg, Univ. California Publ. Zool., 21:29, December 28, type from Victorville, 2700 ft., San Bernardino Co., California.

Marginal records.—California: Oro Grande (Grinnell, 1933:189); type locality.

MICROTUS CALIFORNICUS PALUDICOLA Hatfield.

1935. *Microtus californicus paludicola* Hatfield, Jour. Mamm., 16:316, November 15, type from Melrose Marsh, Alameda Co., California.

Marginal records (Hatfield, 1935:317).—California: W base El Cerrito (Knoll); ½ mi. E Bay Farm Island; Alvarado; Redwood City.

MICROTUS CALIFORNICUS SANCTIDIEGI R. Kellogg.

1918. *Microtus californicus neglectus* R. Kellogg, Univ. California Publ. Zool., 21:31, December 28 (not of Jenyns, 1841), type from Escondido, 640 ft., San Diego Co., California.

1922. *Microtus californicus sanctidiegi* R. Kellogg, Proc. Biol. Soc. Washington, 35:78, March 20 (substitute for *M. c. neglectus* R. Kellogg).

Marginal records.—California: Gaviota Pass (Grinnell, 1933:189); Mt. Piños (Kellogg, 1918:32); Bluff Lake (Grinnell, 1933:189); Fish Creek (Kellogg, 1918:32); Garnet Queen Mine, Santa Rosa Mts. (Kellogg, 1918:31); Mountain Spring (Grinnell, 1933:189); mouth of Tiajuana River (*ibid.*); San Onofre (Kellogg, 1918:31); Santa Ana Cañon (Kellogg, 1918:32); Matilija (*ibid.*); Santa Barbara (Bailey, 1900:35, recorded as *M.* [*c.*] *californicus*).

Microtus californicus scirpensis Bailey.

1900. *Microtus scirpensis* Bailey, N. Amer. Fauna, 17:38, June 6, type from spring near Shoshone, 1560 ft., on Amargosa River, eastern Inyo Co., California. Known from type locality only.

1918. *Microtus californicus scirpensis*, R. Kellogg, Univ. California Publ. Zool., 21:24, December 28.

Microtus californicus stephensi vonBloeker.

1932. *Microtus californicus stephensi* vonBloeker, Proc. Biol. Soc. Washington, 45:134, September 9, type from Playa del Rey, Los Angeles Co., California.

Marginal records (Grinnell, 1933:189).—California: Point Mugu; type locality; Sunset Beach.

Microtus californicus vallicola Bailey.

1898. *Microtus californicus vallicola* Bailey, Proc. Biol. Soc. Washington, 12:89, April 30, type from Lone Pine Creek, 4500 ft., where it cuts through Alhambra Hills near Lone Pine, Inyo Co., California. (A. B. Howell, Jour. Mamm., 4:266, November 1, 1923.)

Marginal records.—California: Benton (Grinnell, 1933:188); head of Willow Creek at N end Panamint Mts. (*ibid.*); Olancha (*ibid.*); Kearsarge Pass (Grays) (Kellogg, 1918:22); Bishop Creek (Bailey, 1900:36).

Microtus townsendii

Townsend Meadow Mouse

Total length, 169-225; tail, 48-70; hind foot, 20-26; ear, 15-17. Fur thin and harsh; ears prominent above fur. Upper parts dark brownish with heavy mixture of black-tipped guard hairs; venter grayish to grayish brown or smoky; tail slightly bicolored, blackish above; body 2.2 to 2.4 times as long as tail; tail 2.2 to 2.6 times as long as hind foot; hip glands conspicuous in adult males; M2 with four closed triangles; incisive foramina long, narrow and constricted posteriorly. Embryos number 5 to 8, with 7 being the mean.

Microtus townsendii cummingi Hall.

1936. *Microtus townsendii cummingi* Hall, Murrelet, 17:15, March 28, type from Bowen Island, Howe Sound, British Columbia. Known from type locality only.

Microtus townsendii laingi Anderson and Rand.

1943. *Microtus townsendi* [*sic*] *laingi* Anderson and Rand, Canadian Field-Nat., 57:74, October 17, type from Port Hardy, Vancouver Island, British Columbia.

Marginal records (Anderson, 1947:158, unless otherwise noted).—Vancouver Island, Canada: Cape Scott; Hurst Island; Sayward; Comox (10147 KU); Beaver Creek, W of Port Alberni, and thence up coast to point of beginning.

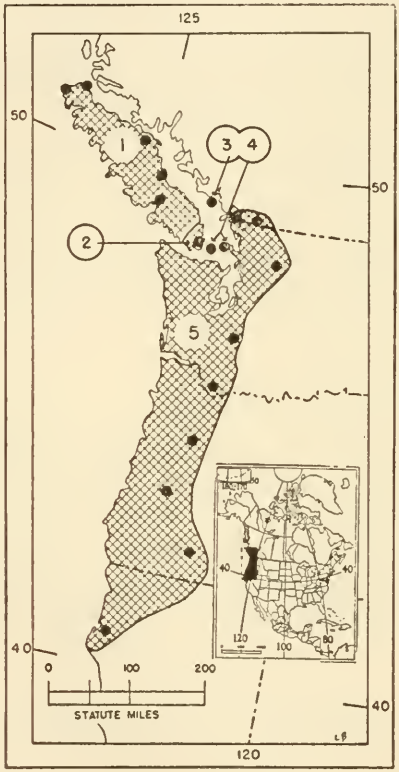


Fig. 41. Distribution of *Microtus townsendii*.

Guide to subspecies
1. *M. t. laingi*
2. *M. t. tetramerus*
3. *M. t. cummingi*
4. *M. t. pugeti*
5. *M. t. townsendii*

Microtus townsendii pugeti Dalquest.

1940. *Microtus townsendii pugeti* Dalquest, Murrelet, 21:7, April 30, type from Neck Point, NW part Shaw Island, San Juan Co., Washington.

Marginal records (Dalquest, 1940:8).—Washington: Friday Harbor, San Juan Island; Strawberry Bay, Cypress Island.

Microtus townsendii tetramerus (Rhoads).

1894. *Arvicola* (*Tetramerodon*) *tetramerus* Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 46:283, October 23, type from Beacon Hill Park, Victoria, Vancouver Island, British Columbia. Known from type locality only.
1936. *Microtus townsendii tetramerus*, Hall, Murrelet, 17:15, March 28.

Microtus townsendii townsendii (Bachman).

1839. *Arvicola townsendii* Bachman, Jour. Acad. Nat. Sci. Philadelphia, 8:60, type from Columbia River; according to Bailey (N. Amer. Fauna, 17:46, June 6, 1900), near mouth of Willamette, on or near Wappatoo (or Sauvie) Island.
1896. *M[icrotus]. townsendi*, Miller, N. Amer. Fauna, 12:66, July 23.
1848. *Arvicola occidentalis* Peale, U. S. Expl. Exped., Mamm. and Ornith., p. 45, type from Puget Sound.

Marginal records.—British Columbia: Port Moody (Anderson, 1947:157); Chilliwak (Bailey, 1900:47). Washington: Sauk (*ibid.*); Nisqually Flats (231034 USBS); Clark County (Dalquest, 1948:351). Oregon: Salem (Bailey, 1900:47); Eugene (Bailey, 1936:206, fig. 44); Prospect (A. B. Howell, 1923:33). California: Humboldt Bay, near Eureka (Grinnell, 1933:189), thence up coast to point of beginning.

Microtus oeconomus

Tundra Vole

Total length, 160-225; tail, 36-53; hindfoot, 20-24. Upper parts vary from dusky gray, with traces of brownish, through rich buff, tawny or cinnamon brown and rusty brown. In all there is a mixture of black-tipped hairs; sides paler; venter white and in some subspecies washed with dark buff; tail varies from slightly to sharply bicolor, pale dusky to black above, whitish to pale buff below; body 2.8-3.6 times as long as tail; tail 1.8 to 2.4 times as long as hind foot; anterior lower molar (m1) has only four closed triangles, fifth triangle being open and confluent with short terminal loop; incisive foramina short and constricted posteriorly.

Microtus oeconomus amakensis O. J. Murie.

1930. *Microtus amakensis* O. J. Murie, Jour. Mamm., 11:74, February 11, type from Amak Island, Bering Sea, Alaska. Known from type locality only.

1952. *Microtus oeconomus amakensis*, Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:309, November 17.

Microtus oeconomus elymocetes Osgood.

1906. *Microtus elymocetes* Osgood, Proc. Biol. Soc. Washington, 19:71, May 1, type from east side of Montague Island, Prince William Sound, Alaska. Restricted to Montague Island (see Heller, Univ. California Publ. Zool., 5:342, March 5, 1910).
1942. *Microtus oec[onomus]. elymocetes*, Zimmermann, Archiv f. Naturgesch., 11:188, September 10.

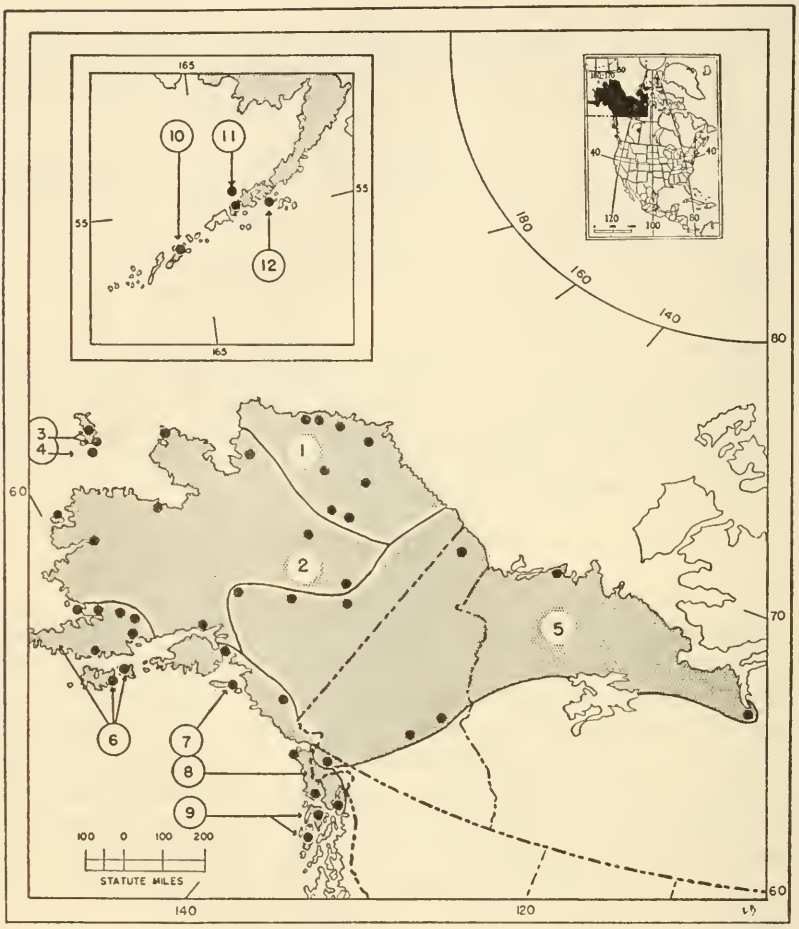


Fig. 42. Distribution of *Microtus oeconomus*.

1. *M. o. gilmorei*
2. *M. o. operarius*
3. *M. o. innuitus*
4. *M. o. punukensis*
5. *M. o. macfarlani*
6. *M. o. kadiacensis*
7. *M. o. elymocetes*
8. *M. o. yakutatensis*
9. *M. o. sitkensis*
10. *M. o. unalascensis*
11. *M. o. amakensis*
12. *M. o. popofensis*

Microtus oeconomus gilmorei Setzer.

1952. *Microtus oeconomus gilmorei* Setzer, Proc. Biol. Soc. Washington, 65:75, April 25, type from Point Lay (163° 04′ W long. and 69° 46′ N lat.), Alaska.

Marginal records (Setzer, 1952:75, unless otherwise noted).—Alaska: 50 mi. S Barrow (Hall, 1929:424, as *M. operarius endoecus*); Umiat; Chandler Lake, 68° 12′, 152° 45′, 2900 ft. (43608 KU); Anaktuvuk Pass; Killik River; type locality; Utukok River, 200 mi. SW Point Barrow; Kaolak River, 70° 11′ 15″, 159° 47′ 40″, 30 ft. (43532 KU).

Microtus oeconomus innuitus Merriam.

1900. *Microtus innuitus* Merriam, Proc. Washington Acad. Sci., 2:21, March 14, type from Northeast Cape, St. Lawrence Island, Bering Sea, Alaska.
1942. *Microtus oec[onomus]. innuitus,* Zimmermann, Archiv f. Naturgesch., 11:188, September 10.

Marginal records.—Alaska: St. Lawrence Island: type locality; Sevoonga (Hall and Gilmore, 1932:392, 399).

Microtus oeconomus kadiacensis Merriam.

1897. *Microtus kadiacensis* Merriam, Proc. Biol. Soc. Washington, 11:222, July 15, type from Kodiak Island, Alaska.
1942. *Microtus oec[onomus]. kadiacensis,* Zimmermann, Archiv f. Naturgesch., 11:187, September 10.

Marginal records (Osgood, 1904:34, unless otherwise noted).—Alaska: Mouth of Chulitna River; Iliamna Village; Litnik, Afognak Island (41403 KU); type locality; Cold Bay; Izembek Bay, Alaska Peninsula (Hall and Cockrum, 1952:309); Nushagak; Kakwok; head of Chulitna River.

Microtus oeconomus macfarlani Merriam.

1900. *Microtus macfarlani* Merriam, Proc. Washington Acad. Sci., 2:24, March 14, type from Fort Anderson, Anderson River, Mackenzie District.
1942. *Microtus oec[onomus]. macfarlani,* Zimmermann, Archiv f. Naturgesch., 11:187, September 10.
1909. *Microtus operarius endoecus* Osgood, N. Amer. Fauna, 30:23, October 7, type from mouth of Charlie Creek, Yukon River, about 50 mi. above Circle, Alaska (see Rausch, Jour. Washington Acad. Sci., 40:135, April 21, 1950, who regards *M. o. endoecus* as inseparable from *M. o. macfarlani*).

Marginal records.—Mackenzie District: Toker Point (Anderson, 1947:157), E along coast to Bathurst Inlet (Banfield, 1951:119). Yukon: Macmillan Pass area (Rand, 1945:42); Rose River (*ibid.*). British Columbia: Stonehouse Creek, 5½ mi. W jct. Stonehouse Creek and Kelsall River (Baker, 1951:111). Alaska: McKinley River (Dixon, 1938:186); Tanana River near Fairbanks (Dice, 1921:24); Circle (Baker, 1951:110). Yukon: Firth River (Rand, 1945A.:64, recorded as *M. operarius*), and along coast east to point of beginning.

Microtus oeconomus operarius (Nelson).

1893. *Arvicola operarius* Nelson, Proc. Biol. Soc. Washington, 8:139, December 28, type from St. Michael, Norton Sound, Alaska.
1942. *Microtus oec[onomus]. operarius,* Zimmermann, Archiv f. Naturgesch., 11:187, September 10.

Marginal records.—Alaska: Kowak [= Kobuk] River (Bailey, 1900:40); Bettles (43646 KU); Fort Yukon (Bailey, 1900:40); Tyonek, Cook Inlet (985 KU); Bethel (Dice, 1921:24); Cape Vancouver (Bailey, 1900:39); type locality; Cape Prince of Wales (Bailey and Hendee, 1926:21).

Microtus oeconomus popofensis Merriam.

1900. *Microtus unalascensis popofensis* Merriam, Proc. Washington Acad. Sci., 2:22, March 14, type from Popof Island, Shumagin Islands, Alaska. Known from type locality only.
1942. *Microtus oec[onomus]. popofensis,* Zimmermann, Archiv f. Naturgesch., 11:187, September 10.

Microtus oeconomus punukensis Hall and Gilmore.

1932. *Microtus innuitus punukensis* Hall and Gilmore, Univ. California Publ. Zool., 38:399, September 17, type from Big Punuk Island, near east end of St. Lawrence Island, Alaska. Known from type locality only.
1942. *Microtus oec[onomus]. punukensis,* Zimmermann, Archiv f. Naturgesch., 11:188, September 10.

Microtus oeconomus sitkensis Merriam.

1897. *Microtus sitkensis* Merriam, Proc. Biol. Soc. Washington, 11:221, July 15, type from Sitka, Alaska.
1942. *Microtus oec[onomus]. sitkensis,* Zimmermann, Archiv f. Naturgesch., 11:187, September 10.

Marginal records.—Alaska: Chichagof Island (Heller, 1909:257); type locality.

Microtus oeconomus unalascensis Merriam.

1897. *Microtus unalascensis* Merriam, Proc. Biol. Soc. Washington, 11:222, July 15, type from Unalaska, Alaska. Known from type locality only.
1942. *Microtus oec[onomus]. unalascensis,* Zimmermann, Archiv f. Naturgesch., 11:187, September 10.

Microtus oeconomus yakutatensis Merriam.

1900. *Microtus yakutatensis* Merriam, Proc. Washington Acad. Sci., 2:22, March 14, type from north shore of Yakutat Bay, Alaska.
1942. *Microtus oec[onomus]. yakutatensis,* Zimmermann, Archiv f. Naturgesch., 11:187, September 1.

Marginal records.—Alaska: [N shore] Prince William Sound (Bailey, 1900: 40); Chitina River Glacier, 4500 ft. (Laing, Anderson, and Taverner, 1929:102); type locality; Glacier Bay (Bailey, 1900:40).

Microtus longicaudus

Long-tailed Meadow Mouse

Total length, 155-221; tail, 50-93; hind foot, 20-25. Upper parts vary from dull grayish bister through brownish gray to dark sepia brown, all with mixture of numerous black-tipped hairs; sides slightly paler causing more reddish back to stand out as a wide band; venter plumbeous with light to heavy wash of whitish to dull buffy; tail long, indistinctly to distinctly bicolor, brownish to black above, soiled whitish to gray below. Body 1.6 to 1.9 times as long as tail; tail 2.8 to 3.5 times as long as hind foot; middle upper molar with four closed triangles; incisive foramina not abruptly constricted posteriorly, but gradually tapered or as wide posteriorly as anteriorly; skull relatively smooth, not heavily ridged even in adults. Embryo counts of 34 females from Wyoming averaged 4.8 (2-7), and in 39 females from Nevada 5.6 (2-8).

Microtus longicaudus abditus A. B. Howell.

1923. *Microtus mordax abditus* A. B. Howell, Jour. Mamm., 4:36, February 9, type from Walker's Ranch, Pleasant Valley, 8 mi. S Tillamook, Tillamook Co., Oregon.

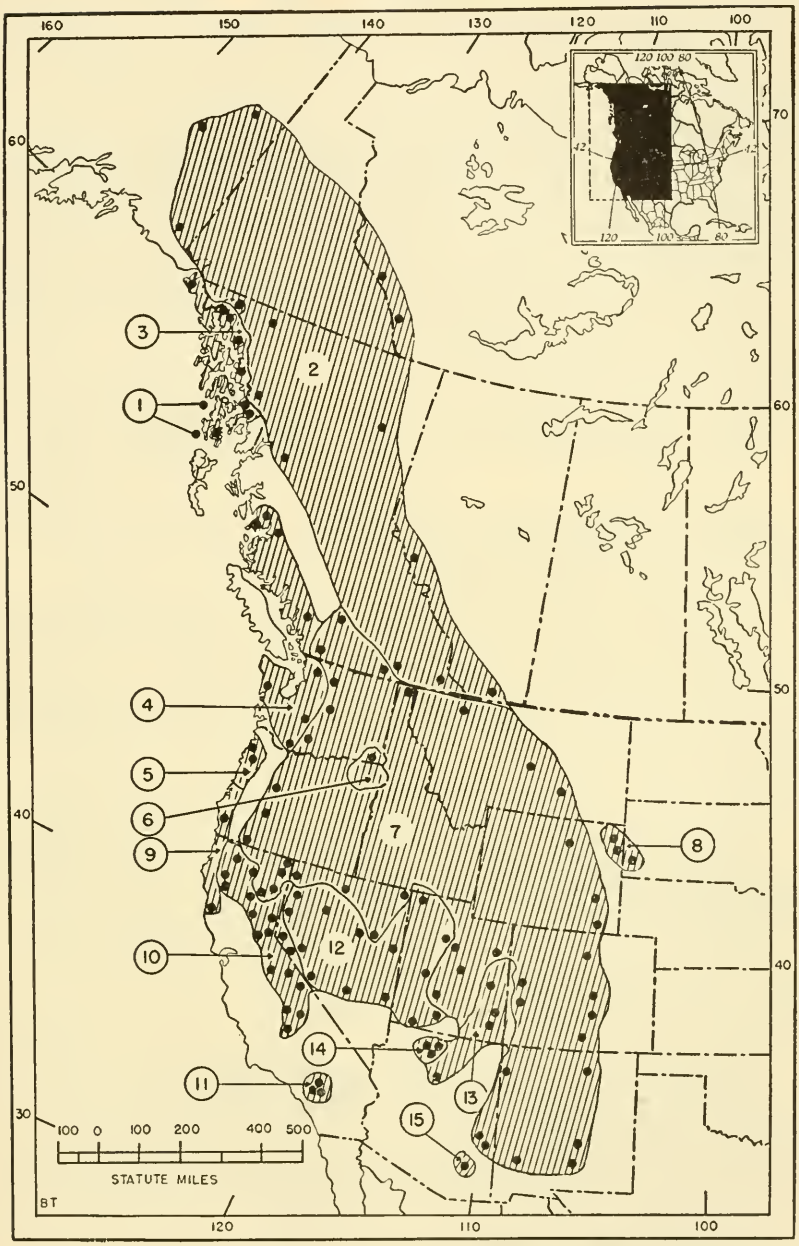


FIG. 43. Distribution of *Microtus longicaudus* and *M. coronarius*.

1. *M. coronarius*
2. *M. l. vellerosus*
3. *M. l. littoralis*
4. *M. l. macrurus*
5. *M. l. abditus*
6. *M. l. halli*
7. *M. l. mordax*
8. *M. l. longicaudus*
9. *M. l. angusticeps*
10. *M. l. sierrae*
11. *M. l. bernardinus*
12. *M. l. latus*
13. *M. l. alticola*
14. *M. l. baileyi*
15. *M. l. leucophaeus*

1938. *Microtus longicaudus abditus*, Goldman, Jour. Mamm., 19:491, November 14.

Marginal records (Bailey, 1936:210).—Oregon: Netarts; type locality.

Microtus longicaudus alticola (Merriam).

1890. *Arvicola* (*Mynomes*) *alticolus* Merriam, N. Amer. Fauna, 3:67, September 11, type from Little Spring, 8200 ft., San Francisco Mtn., Coconino Co., Arizona.
1938. *Microtus longicaudus alticola*, Goldman, Jour. Mamm., 19:491, November 14.

Marginal records (Durrant, 1952:375).—Utah: P. R. Springs, 43 mi. S Ouray, 7950 ft.; Warner Ranger Station, La Sal Mts., 9750 ft.; 5 mi. W Monticello. Arizona: type locality.

Microtus longicaudus angusticeps Bailey.

1898. *Microtus angusticeps* Bailey, Proc. Biol. Soc. Washington, 12:86, April 30, type from Crescent City, Del Norte Co., California.
1938. *Microtus longicaudus angusticeps*, Goldman, Jour. Mamm., 19:491, November 14.

Marginal records.—Oregon: mouth of Rogue River (Bailey, 1936:210). California: Mendocino (Kellogg, 1922:293).

Microtus longicaudus baileyi Goldman.

1938. *Microtus longicaudus baileyi* Goldman, Jour. Mamm., 19:492, November 14, type from Greenland Spring, head of Bright Angel Creek, 8000 ft., Grand Canyon Nat'l Park, Coconino Co., Arizona.

Marginal records (Goldman, 1938:492). — Arizona: Big Springs (6,300-6,700 feet), Kaibab Plateau; type locality; Bright Angel Spring, Kaibab Plateau.

Microtus longicaudus bernardinus Merriam.

1908. *Microtus mordax bernardinus* Merriam, Proc. Biol. Soc. Washington, 21:145, June 9, type from Dry Lake, 9000 ft., San Bernardino Mts., San Bernardino Co., California.
1938. *Microtus longicaudus bernardinus*, Goldman, Jour. Mamm., 19:492, November 14.

Marginal records (Kellogg, 1922:296).—California: Bluff Lake, 7500 ft.; type locality; South Fork Santa Ana River, 8500 ft.

Microtus longicaudus halli Hayman and Holt.

1931. *Microtus mordax angustus* Hall, Univ. California Publ. Zool., 37:13, April 10, type from Godman Springs, 5700 ft., Blue Mts., Columbia Co., Washington (*nec. Microtus angustus* Thomas, 1908).
1948. *Microtus longicaudus halli*, Dalquest, Univ. Kansas Publ., Mus. Nat. Hist., 2:353, April 9.
1941. *Microtus mordax halli* Hayman and Holt *in* Ellerman, Fam. and Genera of Living Rodents, British Mus. Nat. Hist., 2:603, March 21 (new name for *Microtus mordax angustus* Hall).

Marginal records.—Washington (Hall, 1931:13): Humpeg Falls; *Butte Creek;* type locality.

Microtus longicaudus latus Hall.

1931. *Microtus mordax latus* Hall, Univ. California Publ. Zool., 37:12, April 10, type from Wisconsin Creek, 8500 ft., Toyabe Mts., Nye Co., Nevada.

1938. *Microtus longicaudus latus*, Goldman, Jour. Mamm., 19:491, November 14.

Marginal records.—Utah (Durrant, 1952:373): Standrod, Raft River Mts., 5500 ft.; Butterfield Canyon, 3 mi. SW Butterfield Tunnel, 8000 ft.; Britts Meadow, near Delano Ranger Station, 14 mi. E Beaver; Bryce Nat'l Park; Blue Springs, Zion Nat'l Park. Nevada (Hall, 1946:553): 3½ mi. N Ursine, Eagle Valley, 5900 ft.; Breen Creek, Kawich Range, 7000 ft.; Chiatovich Creek, 8200 ft.; Lapon Canyon, Mt. Grant, 8800 ft.; Hardscrabble Canyon; Horse Canyon, Pahrum Peak, 5800-6000 ft.; El Dorado Canyon, Humboldt Range, 7800 ft.; Union; E side Schellbourne Pass, 6800 ft.

Microtus longicaudus leucophaeus (J. A. Allen).

1894. *Arvicola leucophaeus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 6:320, November 7, type from Graham Mts., Graham Co., Arizona. Known from type locality only.
1938. *Microtus longicaudus leucophaeus*, Goldman, Jour. Mamm., 19:491, November 14.

Microtus longicaudus littoralis Swarth.

1933. *Microtus mordax littoralis* Swarth, Proc. Biol. Soc. Washington, 46:209, October 26, type from Shakan, Prince of Wales Island, Alaska [Shakan is on Kosciusko Island and Swarth probably took his specimen on Prince of Wales Island, opposite Shakan].
1938. *Microtus longicaudus littoralis*, Goldman, Jour. Mamm., 19:491, November 14.

Marginal records.—Alaska: Yakutat (Swarth, 1933:209); [Point Gustavus] Glacier Bay (Bailey, 1900:51); E side Chilkat River, 100 ft., 9 mi. W, 4 mi. N Haines (Baker, 1951:110); Juneau (Bailey, 1900:51); Sundum (Howell, 1923:35); Thomas Bay (Swarth, 1911:129); Bradfield Canal (Swarth, 1933:209); Dall Island (Swarth, 1911:129). Bailey (1900:51) used the name *Microtus macrurus*.

Microtus longicaudus longicaudus (Merriam).

1888. *Arvicola* (*Mynomes*) *longicaudus* Merriam, Amer. Nat., 22:934, October, type from Custer, 5500 ft., Black Hills, Custer Co., South Dakota.
1895. *Microtus* (*Mynomes*) *longicaudus*, J. A. Allen, Bull. Amer. Mus. Nat. Hist., 7:266, August 21.

Marginal records.—Wyoming: 3 mi. NW Sundance (20658 KU). South Dakota: type locality. Wyoming: 1½ mi. E Buckhorn, 6150 ft. (42110 KU).

Microtus longicaudus macrurus Merriam.

1898. *Microtus macrurus* Merriam, Proc. Acad. Nat. Sci. Philadelphia, 50:353, October 4, type from Lake Cushman, Olympic Mts., Mason Co., Washington.
1938. *Microtus longicaudus macrurus* Goldman, Jour. Mamm., 19:491, November 14.

Marginal records.—British Columbia: Kimsquit (Anderson and Rand, 1944: 20); Stuie, 454 ft. (Anderson, 1947:158); Alta Lake (*ibid.*). Washington: Sauk (Dalquest, 1948:354); Naches River (*ibid.*); Wind River (*ibid.*); Granville [now Taholah] (Bailey, 1900:51), and thence along coast to: British Columbia: Port John, King Island (Anderson and Rand, 1944:20).

Microtus longicaudus mordax (Merriam).

1891. *Arvicola* (*Mynomes*) *mordax* Merriam, N. Amer. Fauna, 5:61, July 30, type from Sawtooth (or Alturas) Lake, 7200 ft., east base of Sawtooth Mts., Blaine Co., Idaho.
1938. *Microtus longicaudus mordax*, Goldman, Jour. Mamm., 19:491, November 14.

Marginal records.—British Columbia (See Anderson and Rand, 1944:20): Spences Bridge; *Westbridge;* Cascade. Idaho: 4 mi. W Meadow Creek (Davis, 1939:321). Montana (Bailey, 1900:50): Blackfoot; Big Snowy Mts.; Fort Custer. Wyoming: 5½ mi. W, 2 mi. S Buffalo, 5620 ft. (27636 KU); 3 mi. N, 5 mi. E Orin, 4725 ft. (42124 KU); 3½ mi. W Horse Creek P. O., 7000 ft. (15808 KU). Colorado: Estes Park (Bailey, 1900:50); Lake Moraine (6874 MVZ); Canyon City (Bailey, 1900:50); Fort Garland (*ibid.*). New Mexico: Martinez (*ibid.*); Capitan Mts. (Bailey, 1932:196); [Cloudcroft] Sacramento [Mts.] (*ibid.*); [Kingston] Mimbres Mts. (*ibid.*). Arizona: Rose Peak (50845 MVZ); Reservation Creek, 9640 ft. (50898 MVZ). New Mexico: Chuska Mountains (Bailey, 1932:196). Colorado: tributary of San Miguel River, near Coventry, 5500 ft. (Cary, 1911:123); Grand Junction, 4600 ft. (Warren, 1942:230). Utah (Durrant, 1952:374, unless otherwise noted): Vernal, 5300 ft.; Lake Creek, 11 mi. E Mount Pleasant; Wildcat Ranger Station, Boulder Mtn., 8700 ft.; 3½ mi. NE Pleasant Grove (Bee, 1947, MS-MA dissertation). Nevada (Hall, 1946:552): Goose Creek, 2 mi. W Utah boundary, 5000 ft.; W side Ruby Lake, 3 mi. S Elko County line, 6100 ft.; Hansen Canyon, 5 mi. W Paradise Valley, 6200 ft.; 2 mi. W Vya, 6500 ft. California: 5 mi. N Fredonyer Peak, 5700 ft. (Grinnell, Dixon and Linsdale, 1930:526); Butte Lake, 6100 ft. (*ibid.*); Parker Creek (5000-5500 ft.) (Kellogg, 1922:284); Goose Lake, 5150 ft. (*ibid.*). Oregon: Siskiyou (Bailey, 1900:50); Upper Deschutes River, Little Meadow (near head of Deschutes River) (*ibid.*); 15 mi. W Bend (83955 MVZ). Washington (Hall and Cockrum, 1952:311): 8 mi. S Glenwood, base Mt. Adams; 2 mi. S Blewett Pass, 3000 ft.; Hart Lake, Railroad Creek, 3900 ft. British Columbia: Cultus Lake (Anderson and Rand, 1944:20).

Microtus longicaudus sierrae R. Kellogg.

1922. *Microtus mordax sierrae* R. Kellogg, Univ. California Publ. Zool., 21:288, April 18, type from Tuolumne Meadows, 8600 ft., Yosemite Nat'l Park, California.
1938. *Microtus longicaudus sierrae*, Goldman, Jour. Mamm., 19:491, November 14.

Marginal records (Kellogg, 1922:288-9, unless otherwise noted.)—California: Etna (Bailey, 1900:50); Bear Creek (*ibid.*); Lassen Peak (Hudsonian east side); Sierra Valley, 5100 ft.; Independence Lake, 7000 ft. Nevada (Hall, 1946:555): ½ mi. S Mt. Rose, 9500 ft.; *½ mi. S Marlette Lake, 8150 ft.;* Desert Creek, Sweetwater Range, 6250 ft. California: Farringtons Ranch near Mono Lake, 6800 ft.; McCloud Camp, Cottonwood Creek, White Mts., 9200 ft.; *Roberts Ranch, Wyman Creek, White Mts., 8250 ft.;* Monache Meadow, 8000 ft.; Taylor Meadow (Grinnell, 1933:190); Hume, 5300 ft.; El Portal, 2000 ft. (Grinnell, 1933:190); Blue Cañon (4700-5000 ft.); 20 mi. SW Quincy, 5000 ft.; head Bear Creek, 6400 ft.; head Grizzly Creek, 6000 ft.

Microtus longicaudus vellerosus J. A. Allen.

1899. *Microtus vellerosus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 12:7, March 4, type from upper Liard River, British Columbia.
1944. *Microtus longicaudus vellerosus,* Anderson and Rand, Canadian Field-Nat., 58:20, April 1.
1899. *Microtus cautus* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 12:7, March 4, type from Hells Gate, Liard River, British Columbia.

Marginal records.—Alaska: Circle (Bailey, 1900:50). Mackenzie District (Anderson and Rand, 1944:21): Glacier Lake; Nahanni Gates. British Columbia: Sikanni Chief River (Sheldon, 1932:201). Alberta: Jasper Park (Anderson and Rand, 1944:21); Sweet Grass Hills (Anderson, 1947: 159). British Columbia: Newgate (Anderson and Rand, 1944:21); Rossland (Anderson, 1947:159); Nine Mile Mtn. [4500 ft., NE Hazleton] (Munro, 1947:145); Clearwater Creek, "just below the British Columbia-Alaska boundary" (Swarth, 1922:176); Atlin (Anderson and Rand, 1944: 21). Alaska: Skagway (Bailey, 1900:50); Chitina River Glacier (Laing, Anderson and Taverner, 1929:103); N side Salcha River, 600 ft., 25 mi S and 20 mi. E Fairbanks (Baker, 1951:109). Sheldon and Swarth (*supra*) used the name *Microtus mordax mordax.*

Microtus coronarius Swarth

Coronation Island Meadow Mouse

1911. *Microtus coronarius* Swarth, Univ. California Publ. Zool., 7:131, January 12, type from Egg Harbor, Coronation Island, Alaska.

Marginal records (Swarth, 1933:211).—Alaska: type locality; *Warren Island;* Forrester Island.

Total length, 203-232; tail, 70-92; hind foot, 24-26. Upper parts Vandyke brown obscured by black-tipped hairs; sides paler, near broccoli brown; venter dark gray; tail bicolor, blackish above, whitish below. This species is closely related to *M. longicaudus.*

Microtus mexicanus

Mexican Vole

Total length, 121-152; tail, 24-35; hind foot, 17-21; ear, 12-15; weight, 26-43.4 grams. Pelage coarse and lax; upper parts cinnamon buff to dark cinnamon brown, with mixture of black hairs resulting in grizzled-brownish color; sides paler; venter washed with grayish buff to cinnamon, sometimes whitish; tail slightly bicolor, dusky to dark brown above, paler below; incisive foramina short, wide, and truncate posteriorly. Body 3.3 to 3.8 times as long as tail; tail only 1.5 to 1.7 times as long as hind food; mammae 1-1 = 4; anterior lower molar (m1) with extra anterior trefoil. Embryo counts of 19 females from Mexico range from 1 to 4 and average 2.7.

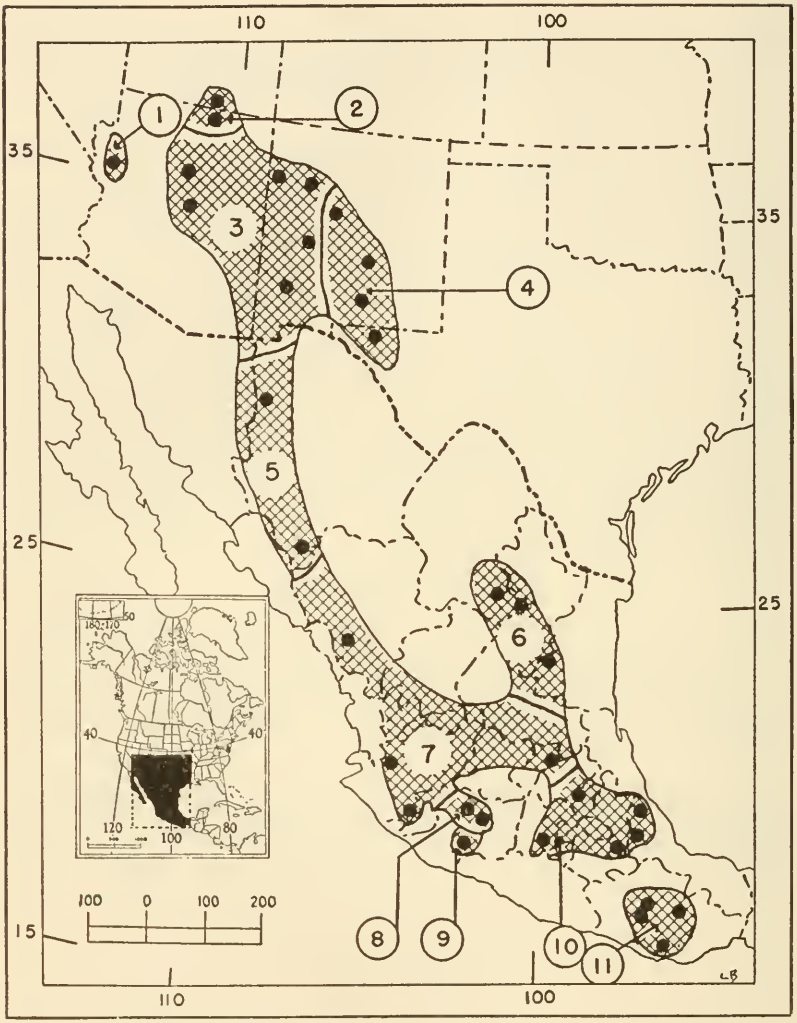


FIG. 44. Distribution of *Microtus mexicanus* and *M. fulviventer*.

Guide to subspecies
1. *M. m. hualpaiensis*
2. *M. m. navajo*
3. *M. m. mogollonensis*
4. *M. m. guadalupensis*
5. *M. m. madrensis*
6. *M. m. subsimus*
7. *M. m. phaeus*
8. *M. m. fundatus*
9. *M. m. salvus*
10. *M. m. mexicanus*
11. *M. fulviventer*

MICROTUS MEXICANUS FUNDATUS Hall.

1948. *Microtus mexicanus fundatus* Hall, Univ. Kansas Publ., Mus. Nat. Hist., 1:425, December 24, type from 3½ mi. S Pátzcuaro, 7900 ft., Michoacán.

Marginal records (Hall and Villa-R, 1949:468).—Michoacán: Nahuatzin; type locality.

Microtus mexicanus guadalupensis Bailey.

1902. *Microtus mexicanus guadalupensis* Bailey, Proc. Biol. Soc. Washington, 15:118, June 2, type from Guadalupe Mts., 7800 ft., El Paso Co., Texas.

Marginal records.—New Mexico (Bailey, 1932:206): Manzano Mts., Captain Mts. Texas: The Bowl, 8000 ft., Guadalupe Mts. (Davis and Robertson, 1944:270). New Mexico: Sacramento Mts. (Bailey, 1932:206).

Microtus mexicanus hualpaiensis Goldman.

1938. *Microtus mexicanus hualpaiensis* Goldman, Jour. Mamm., 19:493, November 14, type from Hualpai Peak, 8400 ft., Hualpai Mts., Mohave Co., Arizona. Known from type locality only.

Microtus mexicanus madrensis Goldman.

1938. *Microtus mexicanus madrensis* Goldman, Jour. Mamm., 19:493, November 14, type from Río Gavilan, 6700 ft., 5 mi. W Colonia García, about 60 mi. SW Casas Grandes, Chihuahua.

Marginal records.—Chihuahua: type locality; Sierra Madre, near Guadalupe y Calvo (Goldman, 1938:494).

Microtus mexicanus mexicanus (Saussure).

1861. *Arvicola (Hemiotomys) mexicanus* Saussure, Revue et Magasin de Zoologie, ser. 2, 13:3, January, type from Volcan de Orizaba, Puebla.
1897. [*Microtus*] *mexicanus*, Trouessart, Catal. Mamm. viv. et foss., p. 564.

Marginal records (Bailey, 1900:54, unless otherwise noted).—Hidalgo: Sierra de Pachuca. Veracruz: 3 km. E Las Vigas, 8000 ft. (19843 KU); Mt. Orizaba (Elliot, 1907:298). Puebla: Chalchicomula. Mexico: N slope Volcan de Toluca.

Microtus mexicanus mogollonensis (Mearns).

1890. *Arvicola mogollonensis* Mearns, Bull. Amer. Mus. Nat. Hist., 2:283, February 21, type from Bakers Butte, Mogollon Mts., Yavapai Co., Arizona.
1932. *Microtus mexicanus mogollonensis*, Bailey, N. Amer. Fauna, 53:204, March 1.

Marginal records.—Arizona: Agassiz Peak, 11,500 ft. (10704 KU). New Mexico: Fort Wingate (Bailey, 1900:57); Mt. Taylor (Bailey, 1932:204); Magdelena Mts. (*op. cit.*:205); E slope Mimbres Mts. near Kingston (*ibid.*). Arizona: type locality.

Microtus mexicanus navaho Benson.

1934. *Microtus mexicanus navaho* Benson, Proc. Biol. Soc. Washington, 47:49, February 9, type from Soldier Spring, 8800 ft., E slope Navajo Mtn., San Juan Co., Utah.

Marginal records.—Utah: type locality. Arizona: 5 mi. E Rainbow Lodge, Navajo Mt. (251044 USBS).

Microtus mexicanus phaeus (Merriam).

1892. *Arvicola phaeus* Merriam, Proc. Biol. Soc. Washington, 7:171, September 29, type from N slope Sierra Nevada de Colima, 10,000 ft., Jalisco.
1900. *Microtus mexicanus phaeus*, Bailey, N. Amer. Fauna, 17:54, June 6.

Marginal records.—Durango: El Salto (Bailey, 1900:55). Queretaro: Pinal de Amoles (*ibid.*). Jalisco: type locality; 10 mi. W, 9 mi. N Magdalena (34129 KU).

Microtus mexicanus salvus Hall.

1948. *Microtus mexicanus salvus* Hall, Univ. Kansas Publ., Mus. Nat. Hist., 1:426, December 24, type from Mt. Tancítaro, 11,400 ft., Michoacán. Known from type locality only.

Microtus mexicanus subsimus Goldman.

1938. *Microtus mexicanus subsimus* Goldman, Jour. Mamm., 19:494, November 14, type from Sierra Guadalupe, southeastern Coahuila.

Marginal records.—Coahuila: type locality; 12 mi. E Antonio de las Alazanas (33295 KU). Tamaulipas: mts. near Miquihuana (Goldman, 1938:495).

Microtus fulviventer Merriam

Oaxaca Vole

1898. *Microtus fulviventer* Merriam, Proc. Biol. Soc. Washington, 12:106, April 30, type from Cerro San Felipe, 10,200 ft., Oaxaca.

Marginal records (Bailey, 1900:56).—Oaxaca: Reyes [Pápalo Santos Reyes]; Mt. Zempoaltepec; mts. near Ozolotepec; 15 mi. W Oaxaca.

Characters.—Average external measurements of ten adult topotypes are: total length, 152; tail, 35; hind foot, 20.4. Upper parts umber brown, darkened by black-tipped hairs; underparts fulvous or dull chestnut brown; tail dusky brown above, fulvous below. This nominal species is closely related to *M. mexicanus.*

Microtus xanthognathus (Leach)

Yellow-cheeked Vole

1815. *Arvicola xanthognatha* Leach, Zool. Miscell., 1:60, type from Hudson Bay.

1896. *M[icrotus]. xanthognathus,* Miller, N. Amer. Fauna, 12:66, July 23.

Marginal records.—Mackenzie District: Arctic coast [Franklin Bay] east of Fort Anderson (Preble, 1908:190); Fort Franklin (Preble, 1908:189); Fort Rae (Bailey, 1900:58); Fort Smith (Preble, 1908:188). Manitoba: Fort Churchill (Preble, 1902:53); Nelson River (Anderson, 1947:160). Alberta (Preble, 1908:189): Athabaska River, 30 mi. above Pelican Portage; Cache Pecotte, 40 mi. E Jasper House. Mackenzie District: Liard River (Preble, 1908:190). Alaska: Eagle (Osgood, 1909:25); south of Fairbanks (Dice, 1921:24); Toklat River, McKinley Nat'l Park (Dixon, 1938:188); near mouth Takotna River (Dice, 1921:24); Yukon 200 mi. [shown as only 100 mi. in fig. 45 herewith] SW of mouth of Porcupine (Bailey, 1900:58); mouth of Porcupine River (*ibid.*). Yukon: La Pierre House (*ibid.*). Mackenzie District: Fort McPherson (Preble, 1908:190).

Total length, 210-218; tail, 45-53; hind foot, 25-27; large adults weigh as much as 170 grams. Upper parts dark sepia to bister, heavily lined with coarse black hairs on back; sides of nose and ear

patch bright rusty yellowish; venter dusky gray; tail indistinctly bicolor, blackish above, dusky gray below; body 3.2 to 3.8 times as long as tail; tail 1.8-1.9 times as long as hind foot; M3 with only 3 closed triangles; middle section of m3 frequently divided into 2 nearly closed triangles; incisive foramina long and narrow. As many as 11 embryos have been found in one female.

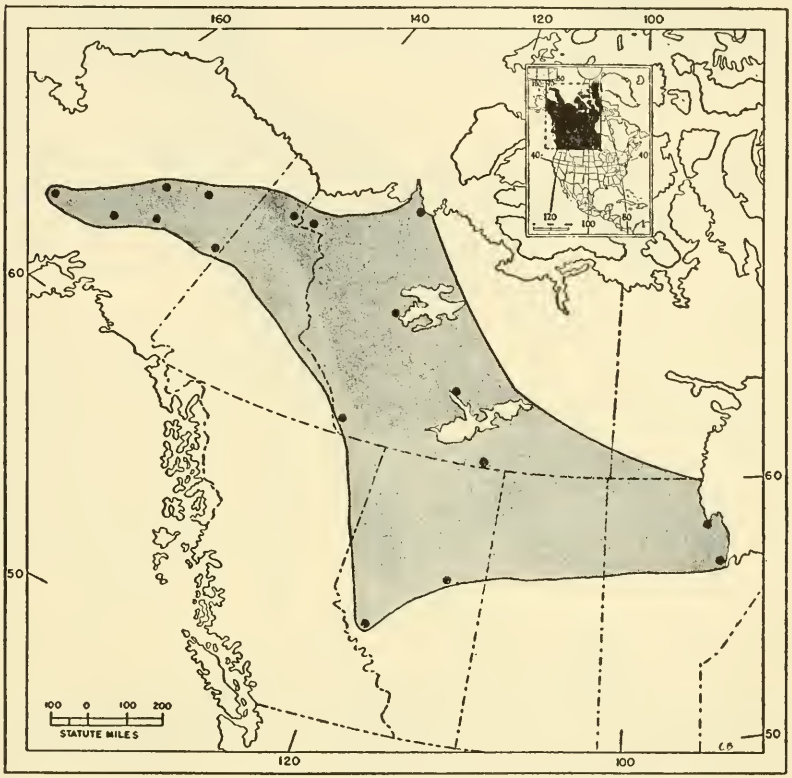


FIG. 45. Distribution of *Microtus xanthognathus*.

Microtus chrotorrhinus

Rock Vole

Total length, 137-170; tail, 45-50; hind foot, 19.4-22. Upper parts grayish bister to bright glossy bister, lined with black-tipped hairs; face, especially from eyes to nose, yellowish to dull orange rufous; venter plumbeous, sometimes with thin whitish wash; tail slightly bicolor, grayish brown to brownish above, paler below, body 2.4 to 2.7 times as long as tail; tail 2.0 to 2.5 times as long as hind foot; M3 with 5 closed triangles; incisive foramina short and wide.

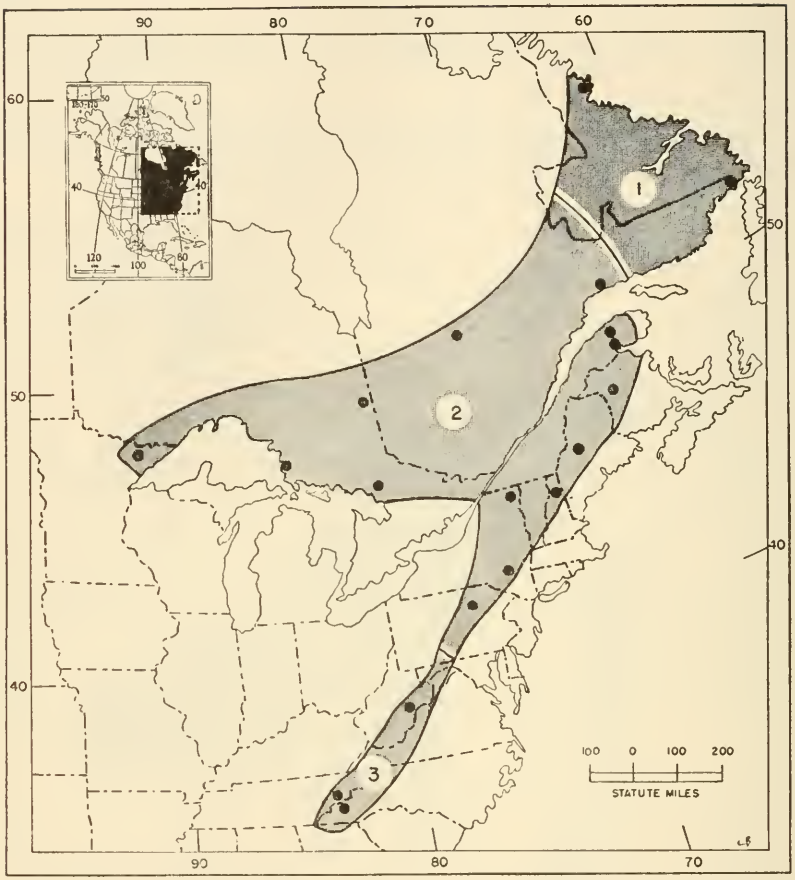


Fig. 46. Distribution of *Microtus chrotorrhinus*.

1. *M. c. ravus* 2. *M. c. chrotorrhinus* 3. *M. c. carolinensis*

Microtus chrotorrhinus carolinensis Komarek.

1932. *Microtus chrotorrhinus carolinensis* Komarek, Jour. Mamm., 13:158, May 11, type from Great Smoky Mts. of North Carolina, about five miles (airline distance) north of Smokemont, Swain Co., on a tributary of Bradley Fork, a small branch of the Oconalufty River, 3200 ft.

Marginal records.—West Virginia: Randolph County (Handley and Patton, 1947:174). North Carolina: type locality. Tennessee: Dry Sluice Trail, 4300 ft., near divide (Mt. Collins) (Komarek, 1932:158).

Microtus chrotorrhinus chrotorrhinus (Miller).

1894. *Arvicola chrotorrhinus* Miller, Proc. Boston Soc. Nat. Hist., 26:190, March 24, type from head of Tuckerman's Ravine, 5300 ft., Mt. Washington, Coos Co., New Hampshire.

1896. *Microtus chrotorrhinus*, Bangs, Proc. Biol. Soc. Washington, 10:49, March 9.

Marginal records.—Quebec: Seal River (Jackson, 1938:433); Mt. Albert, 3500 ft. (Anderson, 1947:159); New Derreen (Goodwin, 1929:244). New Brunswick: Trousers Lake (Komarek, 1932:157). Maine: Mt. Coburn, about 12 mi. N The Forks (Wyman, 1923:126). New Hampshire: type locality. New York: Hunter Mtn. (Miller, 1899:322). Pennsylvania: near Sonestown (Green, 1930:17). New York: Beedes [= Breed's—Bangs, 1898:187] (Miller, 1899:322). Ontario: Timagami (Saunders, 1932:299); Pancake Bay (Anderson, 1947:159). Minnesota: Burntside Lake (Swanson, 1945:90). Ontario: near Lowbush, Lake Abitibi (Saunders, 1932:299). Quebec: Mistassini Lake area [no precise locality given] (Cameron and Morris, 1951:128).

Microtus chrotorrhinus ravus Bangs.

1898. *Microtus chrotorrhinus ravus* Bangs, Proc. Biol. Soc. Washington, 12:188, November 16, type from Black Bay, Strait of Belle Isle, Labrador.

Marginal records (Anderson, 1947:159).—Labrador: Port Manvers; type locality. Not found: Curlew Harbor.

Subgenus AULACOMYS Rhoads

1894. *Aulacomys* Rhoads, Amer. Nat., 28:182, February. Type, *Aulacomys arvicoloides* Rhoads.

Plantar tubercles, 5; side glands on flanks of males conspicuous; musk-bearing anal gland; feet large; tail long; fur full and long; bullae small; incisors projecting far beyond premaxillae; molars with constricted and tightly closed sections; M2 with 4 closed sections; M3 with 3 closed triangles; m1 with 5 closed triangles; m3 with 3 transverse loops.

Microtus richardsoni

Water Vole

Total length, 198-261; tail, 69-92; hind foot, 25-30; ear, 15-20, weight of 2 adult males, 112, 123.3 grams. Pelage long; upper parts grayish sepia to dark sepia or dark reddish brown, often darkened with black-tipped hairs; underparts plumbeous, with white or silvery white wash; tail bicolor, dusky above, grayish below; other characters as given above for the subgenus. Number of embryos varies from 4 to 7.

Microtus richardsoni arvicoloides (Rhoads).

1894. *Aulacomys arvicoloides* Rhoads, Amer. Nat., 28:182, February, type from Lake Keechelus, 8000 ft., Kittitas Co., Washington.
1900. *Microtus richardsoni arvicoloides*, Bailey, N. Amer. Fauna, 17:62, June 6.
1895. *Microtus principalis* Rhoads, Amer. Nat., 29:940, October, type from Mt. Baker Range, British Columbia.

Marginal records (Bailey, 1900:62, unless otherwise noted).—British Columbia: Mt. Baker Range. Washington: Tomyhoi Lake (Dalquest, 1948:356);

Wenatchee. Oregon: Mt. Hood; Mt. Jefferson; Crater Lake; *Prospect* (Howell, 1920:141); Detroit. Washington: Mt. St. Helens.

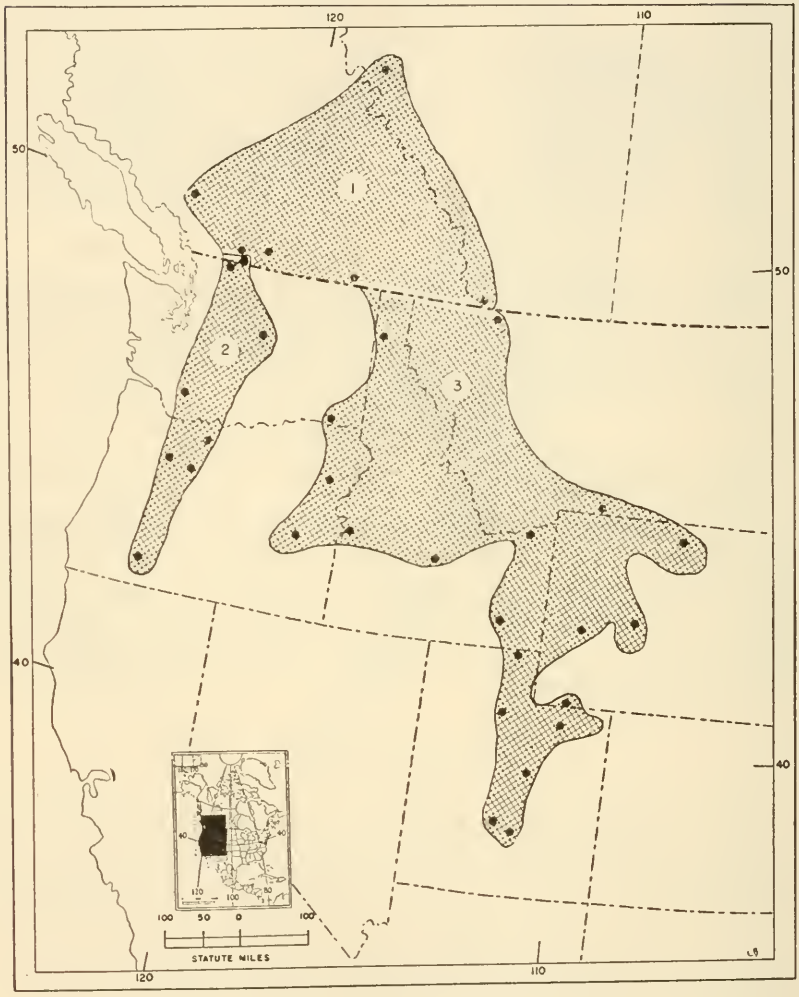


FIG. 47. Distribution of *Microtus richardsoni*.

1. *M. r. richardsoni* 2. *M. r. arvicoloides* 3. *M. r. macropus*

MICROTUS RICHARDSONI MACROPUS (Merriam).

1891. *Arvicola* (*Mynomes*) *macropus* Merriam, N. Amer. Fauna, 5:60, July 30, type from Pahsimeroi Mts., 9700 ft., Custer Co., Idaho.
1900. *Microtus richardsoni macropus*, Bailey, N. Amer. Fauna, 17:61, June 6.

Marginal records.—Montana: 1 mi. W, 2 mi. S Summit (34034 KU); Beartooth Mts. (Bailey, 1900:61). Wyoming: Medicine Wheel Ranch, 9000 ft.,

28 mi. E Lovell (32826 KU); South Pass City (Bailey, 1900:61); LaBarge Creek (*ibid.*); 9 mi. S Robertson, 8400 ft. (26182 KU). Utah (Durrant, 1952:376): Petty Mtn., 15 mi. N Mountain Home, 9000 ft.; 11 mi. E Mt. Pleasant; Elkhorn Guard Station, 14 mi. N Torrey, Fish Lake Plateau, 9400 ft.; Fish Lake Mts.; Lambs Canyon, 13 mi. SE Salt Lake City; 12 mi. W Garden City. Idaho (Davis, 1939:324): Camp Tendoy; Mt. Jefferson, 3 mi. S Montana Line; Alturas Lake; SW slope Cuddy Mtn. Oregon (Bailey, 1900:61): Strawberry Butte; Wallowa Mts. Washington: Stay-a-while Spring (Dalquest, 1948:357). Idaho: Priest Lake (Davis, 1939:324).

Microtus richardsoni richardsoni (DeKay).

1842. *A[rvicola]. richardsoni* DeKay, Zool. New York, Mamm., p. 91, type from "near the foot of the Rocky Mountains." According to Bailey (N. Amer. Fauna, 17:60, June 6, 1900) the type was obtained by Drummond in the vicinity of Jasper House, Alberta.
1897. [*Microtus*] *richardsoni*, Trouessart, Catal. Mamm. viv. et foss. p. 565.

Marginal records.—Alberta: 5 mi. W Henry House (Bailey, 1900:60); Waterton Lake Park (Anderson, 1947:162). British Columbia: Rossland (*ibid.*); Hope-Princeton summit (*ibid.*); Mt. Cheam (Anderson and Rand, 1943B:106); Avalanche Pass (Racey and Cowan, 1935:H27).

Subgenus CHILOTUS Baird

1858. *Chilotus* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 516, July 14. Type, *Arvicola oregoni* Bachman.

Plantar tubercles, 5; side glands obscure or wanting; ears small; fur dense and without stiff hairs; molars small; M3 with 2 or 3 closed triangles; m1 with 5 closed triangles; m2 with anterior pair of triangles usually confluent; m3 with 3 transverse loops.

Microtus oregoni

Creeping Mouse

Total length, 129-154; tail, 32-42; hind foot, 16-19; ear, 9-10, average weight of 10 males and 10 females, respectively, of *M. o. oregoni* 19.3, 19.1 grams. Upper parts varying from sooty gray through mixed bister to yellowish bister; underparts dusky with wash varying from dull buff to whitish; tail indistinctly bicolor, sooty to blackish above, dark gray to silvery gray below; ears blackish, scantily haired, and protruding from fur. Embryos 3 to 5.

Microtus oregoni adocetus Merriam.

1908. *Microtus oregoni adocetus* Merriam, Proc. Biol. Soc. Washington, 21:145, June 9, type from 2 mi. S South Yolla Bolly Mtn., 7500 ft., Tehama Co., California.

Marginal records.—Oregon: Belmont Orchard, 6 mi. S Medford (Hatfield and Hooper, 1935:33). California (Grinnell, 1933:191): type locality; Blake Lookout on South Fork Mtn.

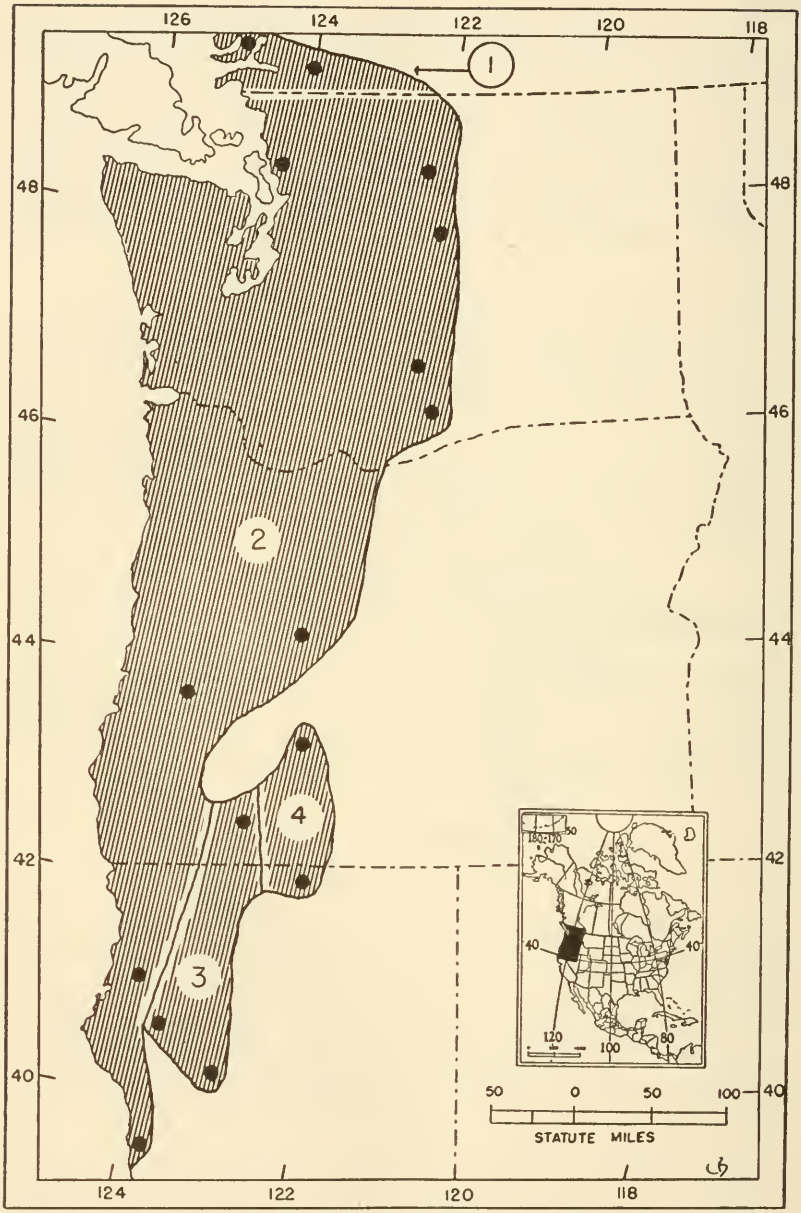


FIG. 48. Distribution of *Microtus oregoni*.

1. *M. o. serpens*
2. *M. o. oregoni*
3. *M. o. adocetus*
4. *M. o. bairdi*

Microtus oregoni bairdi Merriam.

1897. *Microtus bairdi* Merriam, Proc. Biol. Soc. Washington, 11:74, April 21, type from Glacier Peak, 7800 ft., Crater Lake, Klamath Co., Oregon.
1920. *Microtus oregoni bairdi*, Taylor, Jour. Mamm., 1:180, August 24.

Marginal records (Grinnell, 1933:191).—Oregon: type locality. California: Beswick.

Microtus oregoni oregoni (Bachman).

1839. *Arvicola oregoni* Bachman, Jour. Acad. Nat. Sci. Philadelphia, 8(1):60, type from Astoria, Clatsop Co., Oregon.
1896. *Microtus oregoni*, Miller, N. Amer. Fauna, 12:9, July 23.
1899. *Microtus morosus* Elliot, Field Columb. Mus. Publ. 30, zool. ser., 1:227, February 2, type from Boulder Lake, 5000 ft., Olympic Mts., Clallam Co., Washington.
1920. *Microtus oregoni cantwelli* Taylor, Jour. Mamm., 1:180, August 24, type from Glacier Basin, 5935 ft., Mt. Rainier, Pierce Co., Washington (see Dalquest, Univ. Kansas Publ., Mus. Nat. Hist., 2:357, April 9, 1948, who regards *M. o. cantwelli* as inseparable from *M. o. oregoni*).

Marginal records.—Washington: Mt. Vernon (Hatfield and Hooper, 1935: 34; *fide* Dalquest, 1948:357, 358); Stehekin, head of Lake Chelan (Taylor, 1920:181); Entiat River, 20 mi. from mouth (*ibid.*); Mt. Aix, head of Hindoo Creek (*ibid.*); Signal Peak (*ibid.*). Oregon: N base Three Sisters, 5000 ft. (*op. cit.*:182); Elk Head (Bailey, 1900:71). California: Hoopa Valley (*ibid.*); Mendocino City (Grinnell, 1933:191), thence north along coast to point of beginning.

Microtus oregoni serpens Merriam.

1897. *Microtus serpens* Merriam, Proc. Biol. Soc. Washington, 11:75, April 21, type from Agassiz, British Columbia.
1920. *M[icrotus]. o[regoni]. serpens*, Taylor, Jour. Mamm., 1:180, August 24.

Marginal records.—British Columbia: Port Moody (Anderson, 1947:163); type locality.

Subgenus STENOCRANIUS Kastschenko

1901. *Stenocranius* Katschenko, Ann. Mus. St. Petersbourg, 6:167. Type, *Microtus slowzowi* Poljakoff [= *Mus gregalis* Pallas].

Dentition normal but skull unusually narrow; median crest sharp; claws tend to be enlarged; ears small.

Microtus miurus

Singing Vole

Total length, 101-155; tail, 19-41; hind foot, 19-21; ear, 10-14; weight, 22-52.1 grams. Upper parts vary from pale buffy gray through pale ochraceous to pale tawny, lightly mixed with buffy-tipped to black-tipped guard hairs; venter whitish gray to buffy; tail dusky above, buffy to ochraceous below.

Fig. 49. Distribution of *Microtus miurus* and *M. abbreviatus*.

Guide to kinds
1. *M. m. muriei*
2. *M. m. oreas*
3. *M. m. miurus*
4. *M. m. cantator*
5. *M. m. andersoni*
6. *M. a. abbreviatus*
7. *M. a. fisheri*

Microtus miurus andersoni Rand.

1945. *Microtus andersoni* Rand, Bull. Nat. Mus. Canada, 99:42, prior to June 20, type from near headwaters of Little Keele River, 5500 ft., 82 mi. west of Mackenzie River on Canol Road, Mackenzie. Known from type locality only.

1952. *Microtus miurus andersoni*, Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:312, November 17.

Microtus miurus cantator Anderson.

1947. *Microtus cantator* Anderson, Bull. Nat. Mus. Canada, 102:161, January 24, type from mountain top near Tepee Lake, 61° 35′ N, 140° 22′ W, N slope Elias Range, Yukon.

1952. *Microtus miurus cantator*, Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:312, November 17.

Marginal records.—Alaska: Fish Creek, 3400 ft., 5 mi. N, 1 mi. E Paxson (Baker, 1951:108, as *M. cf. cantator*). Yukon: type locality.

MICROTUS MIURUS MIURUS Osgood.

1901. *Microtus miurus* Osgood, N. Amer. Fauna, 21:64, September 26, type from head of Bear Creek, in mts. near Hope City, Turnagain Arm, Cook Inlet, Alaska. Known from type locality only.

MICROTUS MIURUS MURIEI Nelson.

1931. *Microtus muriei* Nelson, Jour. Mamm., 12:311, August 24, type from Kutuk River (tributary of Alatna River), Endicott Mts., Alaska.
1952. *Microtus miurus muriei*, Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:312, November 17.
1950. *Microtus miurus paneaki* Rausch, Jour. Washington Acad. Sci., 40: 135, April 21, type from Tolugak Lake (lat. 68° 24′ N, long. 152° 10′), Brooks Range, Alaska (regarded as inseparable from *M. m. muriei* by Hall and Cockrum, Univ. Kansas Publ., Mus. Nat. Hist., 5:311, November 17, 1952).

Marginal records.—Alaska: 1 mi. W, ¾ mi. N Umiat, 69° 22′ 18″, 152° 08′ 10″, 370 ft. (43730 KU); Lake Schrader (Rausch, 1951:183); Arctic Village (*ibid.*); type locality; *Kuzitrin Lake* (Quay, 1951:95, *fide* Hall and Cockrum, 1952:311); Anvil Peak, Cooper Gulch (Hall and Cockrum, 1952:312); Lava Lake (*op. cit.*:311); Magnet Creek (Quay, 1951:95, *fide* Hall and Cockrum, 1952:311).

MICROTUS MIURUS OREAS Osgood.

1907. *Microtus miurus oreas* Osgood, Proc. Biol. Soc. Washington, 20:61, April 18, type from Toklat River, Alaskan Range, Alaska.

Marginal records.—Alaska: Jarvis Creek (Nelson, 1931:311); N side Mt. McKinley (159120 USBS); Glacier Creek (159161 USBS); Savage River (244051 USBS).

Microtus abbreviatus

Insular Vole

Total length, 160-178; tail, 25-32; hind foot, 22-24. Fur long, concealing ears; upper parts yellowish brown to rich dark buff, sprinkled with black-tipped hairs; underparts creamy white to strong, clear buff; tail sharply or slightly bicolored, a narrow line of dusky to dark brownish above, creamy to buff below. This species is included in the subgenus *Stenocranius* on the authority of Nelson (Jour. Mamm., 12:311, August 24, 1931) and R. M. Gilmore (Abstracts of theses . . ., 1942 Cornell Univ., p. 289, 1943).

MICROTUS ABBREVIATUS ABBREVIATUS Miller.

1899. *Microtus abbreviatus* Miller, Proc. Biol. Soc. Washington, 13:13, January 31, type from Hall Island, Bering Sea, Alaska. Known from type locality only.

MICROTUS ABBREVIATUS FISHERI Merriam.

1900. *Microtus abbreviatus fisheri* Merriam, Proc. Washington Acad. Sci., 2:23, March 14, type from St. Matthew Island, Bering Sea, Alaska. Known from type locality only.

Subgenus HERPETOMYS Merriam

1898. *Herpetomys* Merriam, Proc. Biol. Soc. Washington, 12:107, April 30, 1898. Type, *Microtus guatemalensis* Merriam.

Plantar tubercles, 5; side glands on flanks of males small and obscure or absent; mammae 2-1 = 6, inguinal pair functionless; ears large; pelage long and soft; tail approximately one-third as long as head and body; auditory bullae not reduced; M3 with 3 closed triangles; m1 with 3 closed triangles and an interior confluent pair of triangles opening into terminal loop; m3 with 4 closed sections including a pair of subequal median triangles.

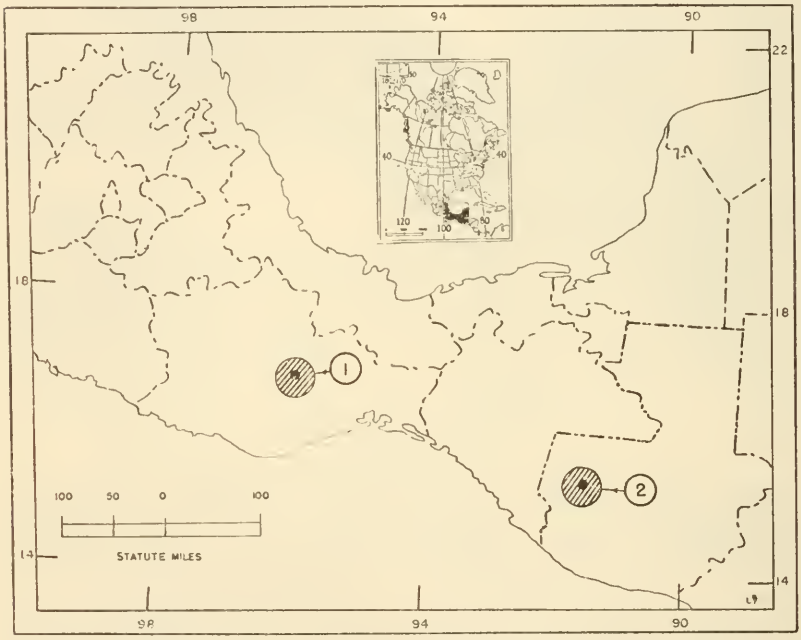


FIG. 50. Distribution of the subgenera *Orthriomys* and *Herpetomys*.

1. *Microtus umbrosus* 2. *Microtus guatemalensis*

Microtus guatemalensis Merriam

Guatemalan Vole

1898. *Microtus guatemalensis* Merriam, Proc. Biol. Soc. Washington, 12:108, April 30, type from Todos Santos, 10,000 ft., Huehuetenango, Guatemala. Known from type locality only.

Average external measurements of 20 specimens: total length, 150; tail, 37; hind foot, 21. Upper parts dark umber brown; nose blackish; lips white; underparts clear plumbeous or lightly washed with dull ochraceous.

Subgenus ORTHRIOMYS Merriam

1898. *Orthriomys* Merriam, Proc. Biol. Soc. Washington, 12:106, April 30, 1898. Type, *Microtus umbrosus* Merriam.

Characters.—Plantar tubercles, 5 (a rudiment of 6th); side glands rudimentary or absent; mammae 2-0 = 4; ears large and almost naked; feet large; tail long, approximately half as long as head and body and scantily haired. Skull long and narrow; bullae small; M3 with 2 closed, rounded triangles and 1 open triangle; m2 with anterior pair of triangles confluent; m3 with posterior loop, 2 closed triangles, and anterior loop.

Microtus umbrosus Merriam

Zempoaltepec Vole

1898. *Microtus umbrosus* Merriam, Proc. Biol. Soc. Washington, 12:107, April 30, type from Mt. Zempoaltepec, 8200 ft., Oaxaca. Known from type locality only.

Average external measurements of 7 specimens: total length, 184; tail, 65; hind foot, 23. Upper parts uniform dusky, with brown-tipped hairs; underparts dark plumbeous thinly washed with fulvous.

Subgenus PEDOMYS Baird

1858. *Pedomys* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 517, July 14. Type, *Arvicola austerus* LeConte [= *Hypudaeus ochrogaster* Wagner].

Characters.—Plantar tubercles, 5; side glands obscure or wanting, rarely discernible; mammae 2-1 = 6; ears medium; fur long and coarse. Molars with wide re-entrant angles; M3 with 2 closed triangles; m1 with 3 closed and 2 open triangles; m2 with anterior pair of triangles confluent; m3 with 3 transverse loops, middle loop sometimes constricted, or even divided into 2 triangles.

Microtus ochrogaster

Prairie Vole

Total length, 130-172; tail, 24-41; hind foot, 17-22; ear, 11-15; weight, in grams, 37.0-48.0. Pelage long, lax, and coarse; upper parts light gray to dark bister, with peppery appearance resulting from mixture of black and whitish, pale fulvous or hazel-tipped hairs; sides paler; venter neutral gray or washed with whitish or pale cinnamon; tail sharply bicolor, dusky to dark bister above, whitish to buffy below. Embryos in 58 females from eastern Kansas ranged from 1 to 7 and averaged 3.4.

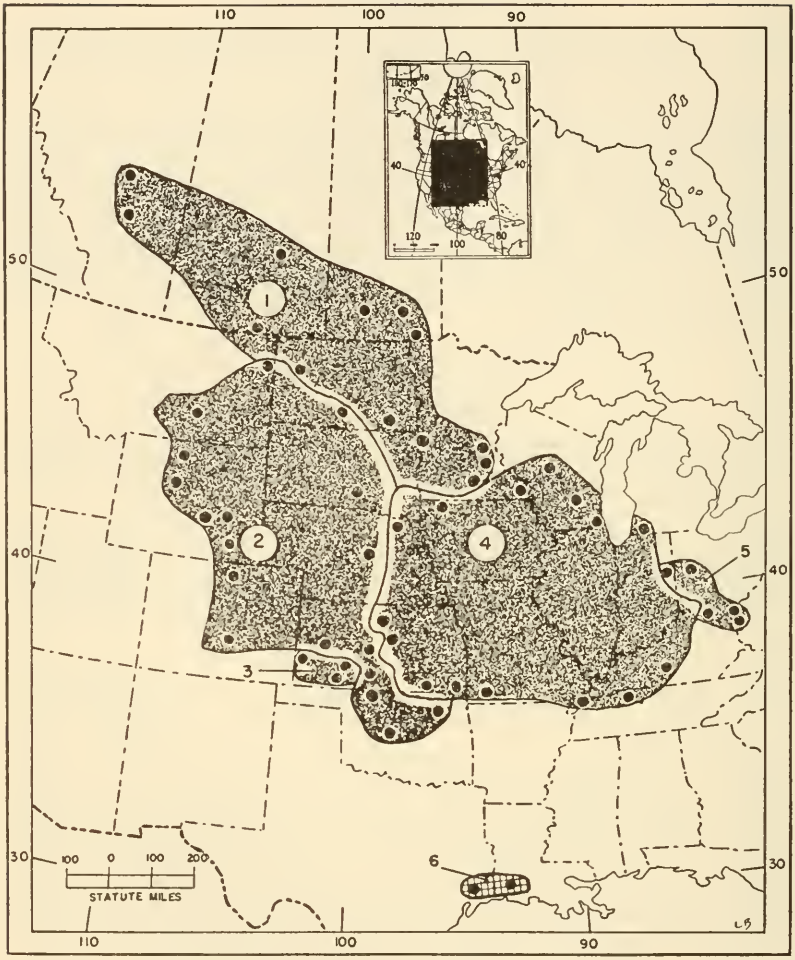


Fig. 51. Distribution of *Microtus ochrogaster* and *M. ludovicianus*.

1. *M. o. minor*
2. *M. o. haydenii*
3. *M. o. taylori*
4. *M. o. ochrogaster*
5. *M. o. ohionensis*
6. *M. ludovicianus*

Microtus ochrogaster haydenii (Baird).

1858. *Arvicola (Pedomys) haydenii* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 543, July 14, type from Fort Pierre, Stanley Co., South Dakota.

1907. *Microtus ochrogaster haydeni*, Osgood, Proc. Biol. Soc. Washington, 20:48, April 18.

Marginal records.—Montana: 3 mi E, 5 mi. S Culbertson, 1860 ft. (27840 KU). North Dakota: Cannon Ball (Bailey, 1927:98). South Dakota: 1 mi. W Oacoma (16081 KU). Nebraska: Callaway (Bailey, 1900:75).

Kansas: 3 mi. N, 2 mi. W Hoisington (Cockrum, 1952:203). Oklahoma: Garnett (Blair, 1939:126); Fort Reno (Bailey, 1900:74); Alva (Blair, 1939:126). Kansas (Cockrum, 1952:203): Cairo; Scott County State Park. Colorado: Cañon City (Cary, 1911:123); Rist Cañon (Warren, 1942:231). Wyoming: 29 mi. N, 8¾ mi. E Laramie, 6420 ft. (27922 KU); Beaver (Bailey, 1900:75); Alcova, 5180 ft. (27856 KU); 12 mi. N, 3 mi. W Shoshone (37888 KU); 1 mi. S Greybull (27855 KU). Montana: Custer Station (Bailey, 1900:75).

MICROTUS OCHROGASTER MINOR (Merriam).

1888. *Arvicola austerus minor* Merriam, Amer. Nat. 22:600, July, type from Bottineau, at base of Turtle Mts., Bottineau Co., North Dakota.
1942. *Microtus ochrogaster minor*, Bole and Moulthrop, Sci. Publs. Cleveland Mus. Nat. Hist., 5:160, September 11.

Marginal records.—Alberta: Edmonton (Anderson, 1947:163). Saskatchewan: Wingard (Bailey, 1900:76). Manitoba: Carberry (*ibid.*); Winnipeg (Soper, 1946:148); Ridgeville (*ibid.*). Minnesota: Elk River (48132 KU); Fort Snelling (Bole and Moulthrop, 1942:160); Nicollet County (Swanson, 1945:92); Ortonville (Bailey, 1900:76). North Dakota (Bole and Moulthrop, 1942:160): Oakes; Goodall. Saskatchewan: Big Muddy Lake (Soper, 1946:148). Alberta: "A short distance east of Red River" (Soper, 1946:147).

MICROTUS OCHROGASTER OCHROGASTER (Wagner).

1842. *Hypudaeus ochrogaster* Wagner, in Schreber's Säugethiere . . ., Suppl., 3:592, type from America, probably from New Harmony, Indiana (see Bole and Moulthrop, Sci. Publs. Cleveland Mus. Nat. Hist., 5:157, September 11, 1942).
1898. *Microtus (Pedomys) ochrogaster*, J. A. Allen, Bull. Amer. Mus. Nat. Hist., 10:459, November 10.
1853. *Arvicola austerus* LeConte, Proc. Acad. Nat. Sci. Philadelphia, 6:405, type from Racine, Wisconsin.
1858. *Arvicola (Pedomys) cinnamonea* Baird, Repts. Expl. and Surv. . . ., Mammals, p. 541, July 14, type supposed by Baird to have come from Pembina, Minnesota [= Pembina, North Dakota?], but see Bailey (N. Amer. Fauna, 17:74, June 6, 1900) who thinks that the type came from somewhere within the geographic range of *M. o. ochrogaster*.

Marginal records.—Wisconsin: western part Clark County (Hanson, 1944: 122); Westpoint Township, Columbia County (*ibid.*); Racine (Bole and Moulthrop, 1942:159). Michigan: Cass County (Burt, 1946:221). Ohio: *Union Township, Clermont County* (Bole and Mouthrop, 1942:159). Kentucky: "vicinity of Canmer" (Barbour and Barbour, 1950:360). Tennessee (Kellogg, 1939:285): Clarksville; Reelfoot, 3 mi. N Tiptonville. Missouri: Crane (38098 KU). Kansas (Cockrum, 1952:204-205): 18 mi. SW Columbus; Cherryvale; Smoky Hill River, 1 mi. S, ½ mi. W Lindsborg; 3½ mi. W, ½ mi. S Beloit. Nebraska: 8 mi. SW Niobrara (336, Nebraska Game, Forestation, and Parks Commission). Iowa: Melvin (Stoner, 1918:91). Minnesota: Winona County (Swanson, 1945:92).

MICROTUS OCHROGASTER OHIONENSIS Bole and Moulthrop.

1942. *Microtus ochrogaster ohionensis* Bole and Moulthrop, Sci. Publs. Cleveland Mus. Nat. Hist., 5:155, September 11, type from Symmes Creek, 2 mi. N Chesapeake, Lawrence Co., Ohio.

Marginal records (Bole and Moulthrop, 1942:156, unless otherwise noted).—Indiana: Salamonia. Ohio: Shelby County; type locality. West Virginia: Spring Valley Golf Course, near Huntington (1142 W. G. Frum). Ohio: Ripley.

Microtus ochrogaster taylori Hibbard and Rinker.

1943. *Microtus ochrogaster taylori* Hibbard and Rinker, Univ. Kansas Sci. Bull., 29(pt. 2, no. 4):256, October 15, type from H. H. Hildebrand Farm, 1½ mi. N Fowler, Meade Co., Kansas.

Marginal records (Cockrum, 1952:205).—Kansas: Coolidge: ½ mi. NW Bellefont; type locality.

Microtus ludovicianus Bailey

Louisiana Vole

1900. *Microtus ludovicianus* Bailey, N. Amer. Fauna, 17:74, June 6, type from Iowa, Calcasieu Parish, Louisiana.

Marginal records.—Louisiana: type locality. Texas: Sour Lake (Taylor and Davis, 1947:63).

Total length, 146-164; tail, 33-36; hind foot, 18.5-19. Upper parts dark gray, with a mixture of black-, brown-, and whitish-tipped hairs resulting in a peppery appearance; venter dark fulvous to dark buffy; tail indistinctly bicolor, dusky above, buffy below. This nominal species is closely related to *M. ochrogaster.*

Subgenus PITYMYS McMurtrie

1831. *Pitymys* McMurtrie, Cuvier's Anim. Kingdom, Amer. ed., 1:434. Type, *Psammomys pinetorum* LeConte.

Skull weak, with relatively small squamosal crests, and supraorbital ridges widely separated in interorbital region of adults; tympanic bullae small; molars narrow; M3 with 2 closed triangles; m1 with 3 closed and 2 open triangles; m2 with anterior pair of triangles confluent; m3 with 3 transverse loops; plantar pads 5. External form modified for semi-fossorial life; fur soft and dense; ear reduced. Sole not fully haired; tail short; mammae 0-2 = 4. Cranially this subgenus closely resembles *Pedomys* but in areas where both subgenera occur can be distinguished by reddish (not grayish or blackish) upper parts, and molelike (not volelike) fur.

Microtus pinetorum

Pine Mouse

Total length, 105-145; tail, 17-25; hind foot, 16-20; ear, 8-12; weight, 25.2-38.8 grams. Upper parts bright russet brown to brownish chestnut, sometimes lined with blackish-tipped hairs on back

and rump; venter plumbeous with wash of dull buff to bright cinnamon; tail indistinctly bicolor or even unicolor, usually same color as back. Nine females of *P. p. nemoralis* from Kansas and Arkansas had an average number of 2.9 (2-5) embryos.

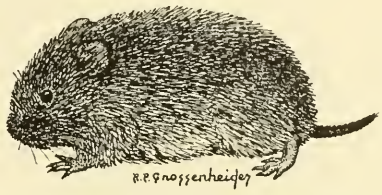


Fig. 52. *Microtus pinetorum nemoralis*, 1 mi. E Winslow, Washington Co., Arkansas, December 25, 1934; ♂ 10999 KU. × ½.

Microtus pinetorum auricularis Bailey.

1898. *Microtus pinetorum auricularis* Bailey, Proc. Biol. Soc. Washington, 12:90, April 30, type from Washington, Adams Co., Mississippi.

Marginal records.—Ohio: Union Township, Clermont Co. (Bole and Moulthrop, 1942:163). Kentucky: Monticello (Handley, 1952:153). Tennessee: LaFollette (*ibid.*). North Carolina: Cherokee County (*ibid.*). Alabama: Sand Mtn. near Carpenter (A. H. Howell, 1921:55). Mississippi: Jones County (Handley, 1952:153). Louisiana: Baton Rouge (Lowery, 1943:247). Texas: 3 mi. S Kerrville (Taylor and Davis, 1947:63); Jefferson (Bailey, 1905:120). Illinois: Olive Branch (Owen and Shackelford, 1942: 307); Reevesville (Necker and Hatfield, 1941:55). Indiana: Worthington (Handley, 1952:153).

Microtus pinetorum carbonarius (Handley).

1952. *Pitymys pinetorum carbonarius* Handley, Jour. Washington Acad. Sci., 42:152, May, type from Eubank, Pulaski Co., Kentucky.

Marginal records (Handley, 1952:153).—Ohio: Symmes Creek. Virginia: Cleveland. Tennessee: Watauga Valley; Jefferson County; High Cliff. Kentucky: Quicksand.

Microtus pinetorum nemoralis Bailey.

1898. *Microtus pinetorum nemoralis* Bailey, Proc. Biol. Soc. Washington, 12:89, April 30, type from Stilwell, Adair Co., Oklahoma.

Marginal records.—Minnesota: Caledonia (Swanson, 1945:92). Wisconsin: Lynxville (Jackson, 1941:202). Iowa: Iowa City (Scott, 1937:78). Missouri: Kimmswick (Bailey, 1900:66); Williamsville (*ibid.*). Arkansas: Beebe (*ibid.*); Fourche Bayou, near Little Rock (Dellinger and Black, 1940:190); Cove (22928 KU). Oklahoma (Blair, 1939:126): Norman; Indiahoma; Logan County. Kansas (Cockrum, 1952:201): 3 mi. SE Arkansas City; Manhattan. Nebraska: London (Jones and Webb, 1949: 312). Iowa: Council Bluffs (Bailey, 1900:66); Decorah (83383 U. Mich.).

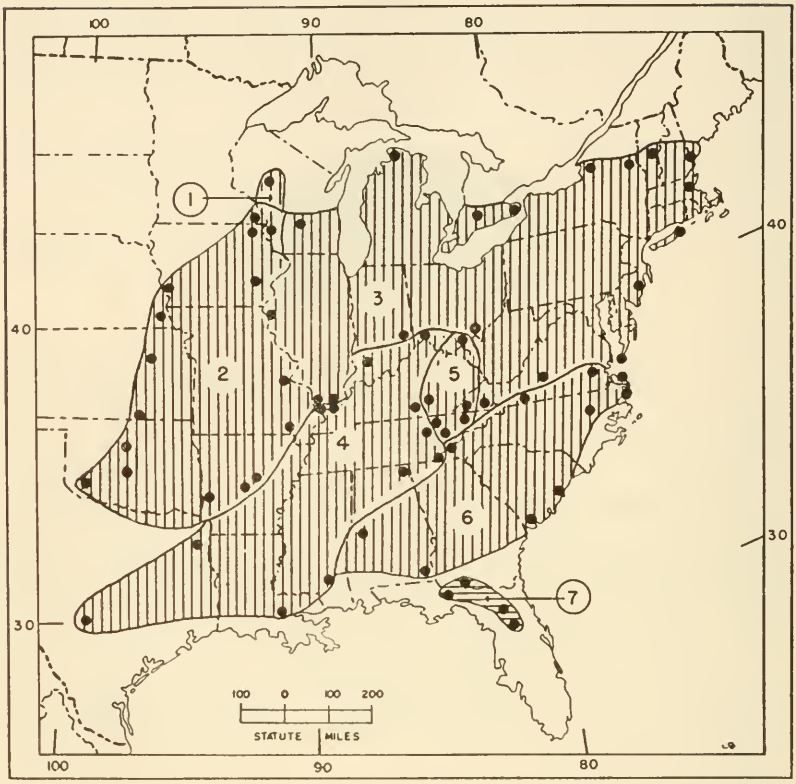


Fig. 53. Distribution of *Microtus pinetorum* and *M. parvulus*.

Guide to kinds
1. *M. p. schmidti*
2. *M. p. nemoralis*
3. *M. p. scalopsoides*
4. *M. p. auricularis*
5. *M. p. carbonarius*
6. *M. p. pinetorum*
7. *M. parvulus*

Microtus pinetorum pinetorum (LeConte).

1830. *Psammomys pinetorum* LeConte, Ann. Lyc. Nat. Hist., New York, 3:133, type from pine forests of Georgia, probably on the LeConte plantation, near Riceboro, Liberty Co.

1896. *Microtus pinetorum*, Miller, N. Amer. Fauna, 12:9, July 23.

Marginal records.—Virginia: Prince George County (Handley and Patton, 1947:175). North Carolina: Currituck (Bole and Moulthrop, 1942:161); Tarboro (Bailey, 1900:64). South Carolina: Georgetown (Handley, 1952: 153); Beaufort (Penny, 1950:86). Alabama (A. H. Howell, 1921:54): Ashford; Greensboro. North Carolina: *Highlands* (Odum, 1949:191); Marshall (Handley, 1952:153). Virginia: Patrick County (Handley and Patton, 1947:175).

Microtus pinetorum scalopsoides (Audubon and Bachman).

1841. *Arvicola scalopsoides* Audubon and Bachman, Proc. Acad. Nat. Sci. Philadelphia, 1:97, October, type from Long Island, New York.
1896. *Microtus pinetorum scalopsoides*, Batchelder, Proc. Boston Soc. Nat. Hist., 27:187, October.
1853. *Arvicola apella* LeConte, Proc. Acad. Nat. Sci. Philadelphia, 6:405, type from Pennsylvania.
1858. *Arvicola kennicottii* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 547, July 14, type from Illinois.

Marginal records.—Michigan: Emmet County (Burt, 1946:224). Ontario: near London (Anderson, 1947:163); Point Abino (Jameson, 1943:196). New York: Lewis County (Miller, 1899:326); Lake George (Copeland, 1912:160). Vermont: Sherburne (Osgood, 1938:439). New Hampshire: Durham (Eadie, 1939:160). Massachusetts: Saugus, about 9 mi. N Boston (Johnson, 1935:68). New York: Montauk Point, Long Island (Owen and Shackelford, 1942:307). New Jersey: Tuckerton (Bailey, 1900:64). Virginia: Cape Charles (*ibid.*); Wallaceton (*ibid.*); Campbell County (Handley and Patton, 1947:175); Washington County (*ibid.*). Ohio: Hocking (Bole, 1938:377). Indiana: Brookville (Handley, 1952:153). Illinois (Necker and Hatfield, 1941:55): Metropolis; Alto Pass; Warsaw. Wisconsin: near Prairie du Sac (Hanson, 1944:124).

Microtus pinetorum schmidti (Jackson).

1941. *Pitymys pinetorum schmidti* Jackson, Proc. Biol. Soc. Washington, 54:201, December 8, type from Worden Township, Clark Co., Wisconsin. Known from type locality only.

Microtus parvulus (Howell)

Florida Pine Mouse

1916. *Pitymys parvulus* Howell, Proc. Biol. Soc. Washington, 29:83, April 4, type from "near the town of Lynne, Marion County, Florida" (see Howell, Jour. Mamm., 15:72, February 15, 1934).

Marginal records.—Georgia: 10 mi. SSW Thomasville (Quay, 1949:67). Florida: Gainesville (Sherman, 1929:258); type locality; Quincy (Sherman, 1937:120).

Total length, 107-113; tail, 15-25; hind foot, 13-15; "upper parts tawny, shading on the sides and tail to vinaceous-cinnamon; underparts dusky, faintly shaded with vinaceous-cinnamon" (Hamilton, 1943:338). This species is much paler and smaller than either *M. pinetorum* or *M. quasiater*, and nothing is known of its life history or reproductive habits.

Microtus quasiater (Coues)

Jalapa Pine Mouse

1874. *Arvicola* (*Pitymys*) *pinetorum* var. *quasiater* Coues, Proc. Acad. Nat. Sci. Philadelphia, 26:191, December 15, type from Jalapa, Veracruz.
1896. *M[icrotus]. quasiater*, Miller, N. Amer. Fauna, 12:60, July 23.

Marginal records (Dalquest, 1950:11, unless otherwise noted).—San Luís Potosí: Apetsco. Veracruz: 5 km. N Jalapa (19875 KU); Orizaba. Puebla: Huauchinango (Bailey, 1900:67).

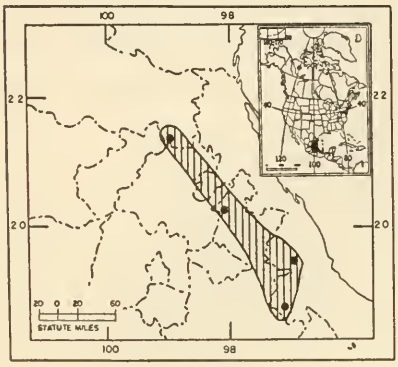


FIG. 54. Distribution of *Microtus quasiater*

Total length, 112-137; tail, 17-25; hind foot, 17-19; ear, 11-18. Uniform dark umber or seal brown above, slightly paler on venter; tail slightly paler below than above. Average number of embryos for 11 females from 5 km. N Jalapa, 4500 ft., Veracruz, was 2.2 (1-4).

Genus LAGURUS Gloger

1841. *Lagurus* Gloger, Gemeinn. Hand- u. Hilfsbuch d. Naturgesch., 1:97. Type, *Lagurus migratorius* Gloger = *Mus lagurus* Pallas.
1881. *Eremiomys* Polyakoff, Mem. Acad. Imp. Sci. St. Petersbourg, 39, supplement, p. 34. Type, *Mus lagurus* Pallas.
1912. *Lemmiscus* Thomas, Ann. Mag. Nat. Hist., ser., 8, 9:401, April. Type, *Arvicola curtata* Cope.

External measurements as given below for the species; basal length, 20.0-23.2; zygomatic breadth, 13.2-15.0. Body thickset and lemminglike; tail short, approximately the length of the hind foot; sole of hind foot densely haired, with 5 concealed pads; ears short and more or less covered with light gray fur; mammae 2-2 = 8; cheek-teeth evergrowing with widely-open folds and lacking cement in the folds; skull angular, flattened and with prominent peglike squamosal crests; supraorbital ridges, although strong, not fused in interorbital region; auditory bullae large, projecting posteriorly beyond plane of occiput, cancellous and foamlike in structure.

The American species have been separated, under the subgeneric name *Lemmiscus* Thomas, from The Old World representatives, on

FIG. 55. *Lagurus curtatus levidensis*, 11 mi. W Waltman, 6950 ft., Natrona Co., Wyoming, July 13, 1951; ♂ 42457 KU. × ½.

the basis of the following characters: antitragus present (rather than absent); ear more than half as long as hind foot; cement present in re-entrant angles of molars; four (not five) closed triangles in m3. On the basis of these features, some workers have considered the American forms as sufficiently distinct to warrant generic separation, under the name *Lemmiscus*.

Lagurus curtatus

Sagebrush Vole

Total length, 108-142; tail, 16-28; hind foot, 14-18; ear, 9-13; weight, in grams, 17.5-24.8. Pelage long and lax; upper parts pale buffy gray to ashy gray; ears and nose tinged with buff; sides paler; venter silvery or soiled whitish to buffy; tail indistinctly bicolor, with dusky line above but silvery white to buffy below. Embryos in 33 females from Wyoming, Nevada, and Washington ranged from 3 to 8 and averaged 6.1.

LAGURUS CURTATUS CURTATUS (Cope).

1868. *Arvicola curtata* Cope, Proc. Acad. Nat. Sci. Philadelphia, 20:2, type from Pigeon Spring, Mt. Magruder, Nevada, near boundary between Inyo Co., California, and Esmeralda Co., Nevada.

1912. *Lagurus curtatus,* Thomas, Ann. and Mag. Nat. Hist., ser. 8, 9:401, April.

1877. *Arvicola decurtata* Coues, Monograph N. Amer. Rodentia, p. 215 (in text), *nomen nudum.*

Marginal records (Hall, 1946:561, unless otherwise noted).—Nevada: 11 mi. SE Reno; Breen Creek, Kawich Mts.; S end Belted Range, 5½ mi. NW Whiterock Spring; Mt. Magruder, Indian Spring. California (Bailey, 1900: 68): Inyo Mts.; White Mts.; *Mono Mills* (Grinnell, 1933:191). Nevada: Chiatovich Creek; Lapon Canyon, Mt. Grant.

LAGURUS CURTATUS INTERMEDIUS (Taylor).

1911. *Microtus (Lagurus) intermedius* Taylor, Univ. California Publ. Zool., 7:253, June 24, type from head of Big Creek, 8000 ft., Pine Forest Mts., Humboldt Co., Nevada.

1934. *Lagurus curtatus intermedius,* Borell and Ellis, Jour. Mamm., 15:35, February 15.

Marginal records (Hall, 1946:560, unless otherwise noted).—Nevada: 4 mi. S Diessner; 5 mi. N Summit Lake; 1 mi. SE Tuscarora, 5900 ft. Utah (Durrant, 1952:380): Grouse Creek, Raft River Mts., 6500 ft.; Butterfield Canyon, 3 mi. SW Butterfield Tunnel, 7000 ft.; Daves Hollow, Bryce Canyon Nat'l Park. Nevada: Dutch Flat Schoolhouse, Reese River. California: Madeline Plains, 6 mi. E Ravendale (Orr, 1932:167). Nevada: 15 mi. S Vya.

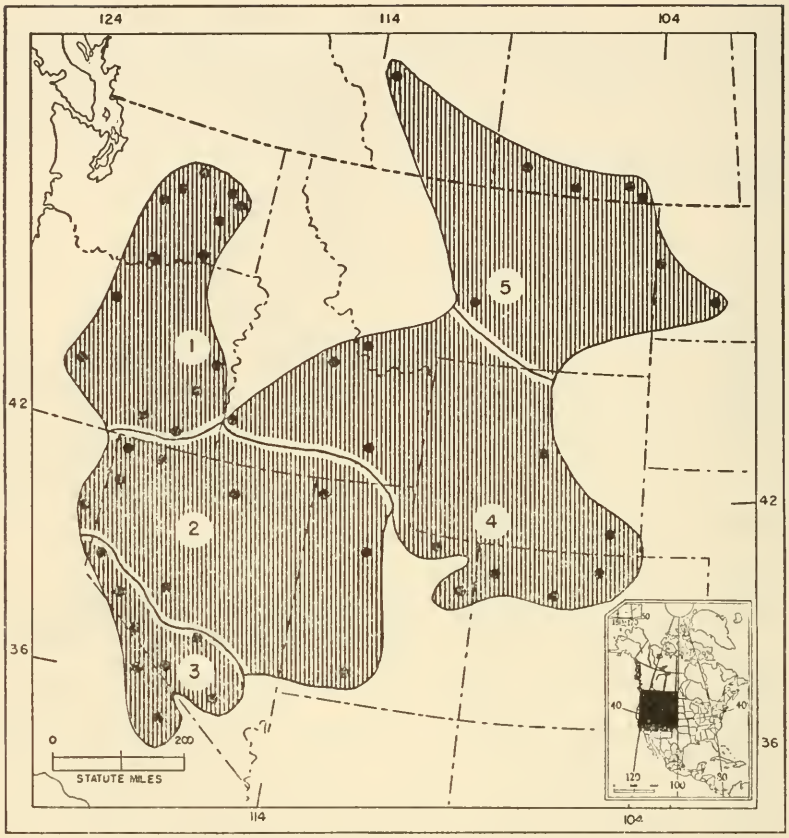


Fig. 56. Distribution of *Lagurus curtatus*.

Guide to kinds
1. *L. c. pauperrimus*
2. *L. c. intermedius*
3. *L. c. curtatus*
4. *L. c. levidensis*
5. *L. c. pallidus*

Lagurus curtatus levidensis (Goldman).

1941. *Lemmiscus curtatus levidensis* Goldman, Proc. Biol. Soc. Washington, 54:70, July 31, type from 5 mi. E Canadian River, west base Medicine Bow Range, 8000 ft., east of Walden, North Park, Jackson Co., Colorado.

1951. *Lagurus curtatus levidensis*, Kelson, Jour. Mamm., 32:114, February 15.

Marginal records (Goldman, 1941:71, unless otherwise noted).— Montana: Donovan. Wyoming: 16 mi. S, 11 mi. W Waltman, 6950 ft. (42457 KU); 5 mi. N Horse Creek P. O. (15830 KU). Colorado: Ft. Collins; Toponas; 8 mi. S Lily. Utah (Durrant, 1952:380): Browns Corral, 20 mi. S Ouray, 6250 ft.; Blacks Fork, 10,000 ft.; Uinta Mts. Idaho: American Falls; 45 mi. SE Silver City; Salmon River Mts.

LAGURUS CURTATUS PALLIDUS (Merriam).

1888. *Arvicola (Chilotus) pallidus* Merriam, Amer. Nat., 22:704, August, type from Fort Buford, Williams Co., North Dakota.
1912. *L[agurus]. pallidus,* Thomas, Ann. and Mag. Nat. Hist., ser. 8, 9:401, April.
1941. *Lemmiscus curtatus pallidus,* Goldman, Proc. Biol. Soc. Washington, 54:70, July 31.

Marginal records.—Alberta: Calgary (Anderson, 1947:164). Saskatchewan (Soper, 1946:148): Eastend; 6 mi. NW Val Marie; Big Muddy Coulee, 10 mi. SE Willowbunch Lake; Big Muddy Lake. North Dakota: type locality; Glen Ullin (Bailey, 1927:101). Montana: Philbrook (Bailey, 1900:69).

LAGURUS CURTATUS PAUPERRIMUS (Cooper).

1868. *Arvicola pauperrima* Cooper, Amer. Nat., 2:535, December, type from plains of the Columbia, near the Snake River, southwestern Washington.
1946. *[Lagurus curtatus] pauperrimus,* Hall, Mammals of Nevada, p. 560, July 1.
1913. *Microtus (Lagurus) curtatus artemisiae* Anthony, Bull. Amer. Mus. Nat. Hist., 32:14, March 7, type from Ironside, 4000 ft., Malheur Co., Oregon (Bailey, N. Amer. Fauna, 55:214, August 29, 1936, regards *M. c. artemisiae* as inseparable from *L. c. pauperrimus*).

Marginal records.—Washington (James and Booth, 1952:28): 3 mi. W Delrio; 11 mi. E Creston; 5 mi. N Edwall; 2 mi. SW Ritzville; Great Plain of Columbia near Snake River (p. 27). Oregon: Ironside (Bailey, 1936: 214); Creston (*ibid.*); Steens Mts. (Bailey, 1900:70); Rock Creek, N side Hart Mtn. (Bailey, 1936:214); Fort Rock (*ibid.*); Antelope (Bailey, 1900: 70). Washington (James and Booth, 1952:28): 10 mi. SE Bickleton; 8 mi. N Kittitas; 8 mi. SW Waterville. (Not found: 2 mi. E Vomer.)

Genus NEOFIBER True—Round-tailed muskrat

1884. *Neofiber* True, Science, 4:34, July 11. Type, *Neofiber alleni* True.

Total length, 307-353; tail, 116-168; hind foot, 40-50; ear, 15-22; weight, 162-270 grams; basal length of skull, 42.8-47.6; zygomatic breadth, 26.0-29.7. Externally modified for aquatic life, but less

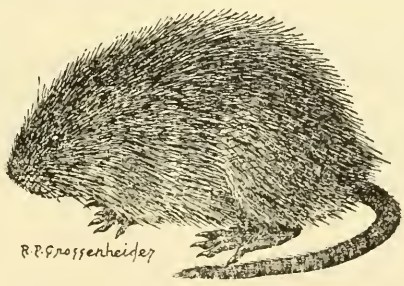


FIG. 57. *Neofiber alleni nigrescens,* 2 mi. S Gainesville, Alachua Co., Florida, April 27, 1948; ♂ 27268 KU. × ½.

so than *Ondatra;* tail round, with long hairs partly covering it; hind foot larger than forefoot; swimming-fringes on feet and tail not

highly developed. Mammae 1-2 = 6. Upper parts sorghum brown to blackish brown; venter grayish-white with buffy to avellaneous wash. Skull much as in *Ondatra* except smaller and structure of lower molars (m1 with five [not six] triangles between anterior loop and posterior loop; anterior loop rounded and with shallow re-entrant angles; m3 reduced, has only one outer fold [not two] and two [instead of three] salient angles).

Neofiber alleni

Round-tailed muskrat

As described for the genus. Embryos or young less than one month of age have been recorded in the months of January, February, March, April, June and August. The number of embryos recorded is one and two. Although *Neofiber* swims it is more a bog animal than an aquatic animal.

Neofiber alleni alleni True.

1884. *Neofiber alleni* True, Science, 4:34, July 11, type from Georgiana, Brevard Co., Florida.

Marginal records (Sherman, 1937:120).—Florida: Titusville; Eden.

Neofiber alleni nigrescens Howell.

1920. *Neofiber alleni nigrescens* Howell, Jour. Mamm., 1:79, March 2, type from Ritta, south shore of Lake Okeechobee, Palm Beach Co., Florida.

Marginal records.—Georgia: Cowhouse Island, Okefinokee Swamp (Harper, 1927:360); Woodbine (Schantz and Jenkins, 1950:461). Florida: Crescent City (Sherman, 1937:121); Canal Point (*ibid.*); Zona (near Fort Lauderdale) (*ibid.*); probably thence west to coast and along coast to: Carrabelle (Sherman, 1945:201). Schwartz (1952:3) listed specimens from Gainesville and 3 miles east of Hawthorne as referable to *N. a. alleni*.

Neofiber alleni struix Schwartz.

1952. *Neofiber alleni struix* Schwartz, Chicago Acad. Sci., Nat. Hist. Misc., 101:1, February 15, type from 21 mi. W Miami, Dade Co., Florida.

Marginal records (Schwartz, 1952:3, unless otherwise noted).—Florida: Hialeah; Cape Sable (Sherman, 1937:121, as *N. a. nigrescens*); 8 mi. E Chokoloskee; 23 mi. W Miami.

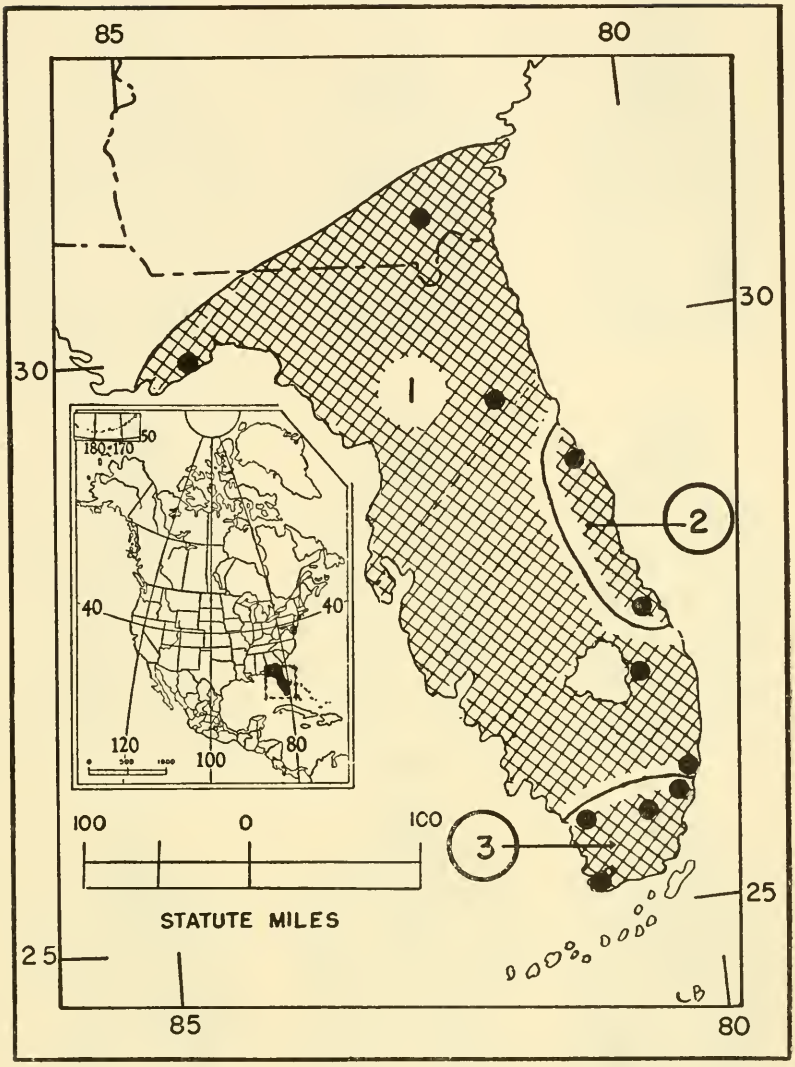
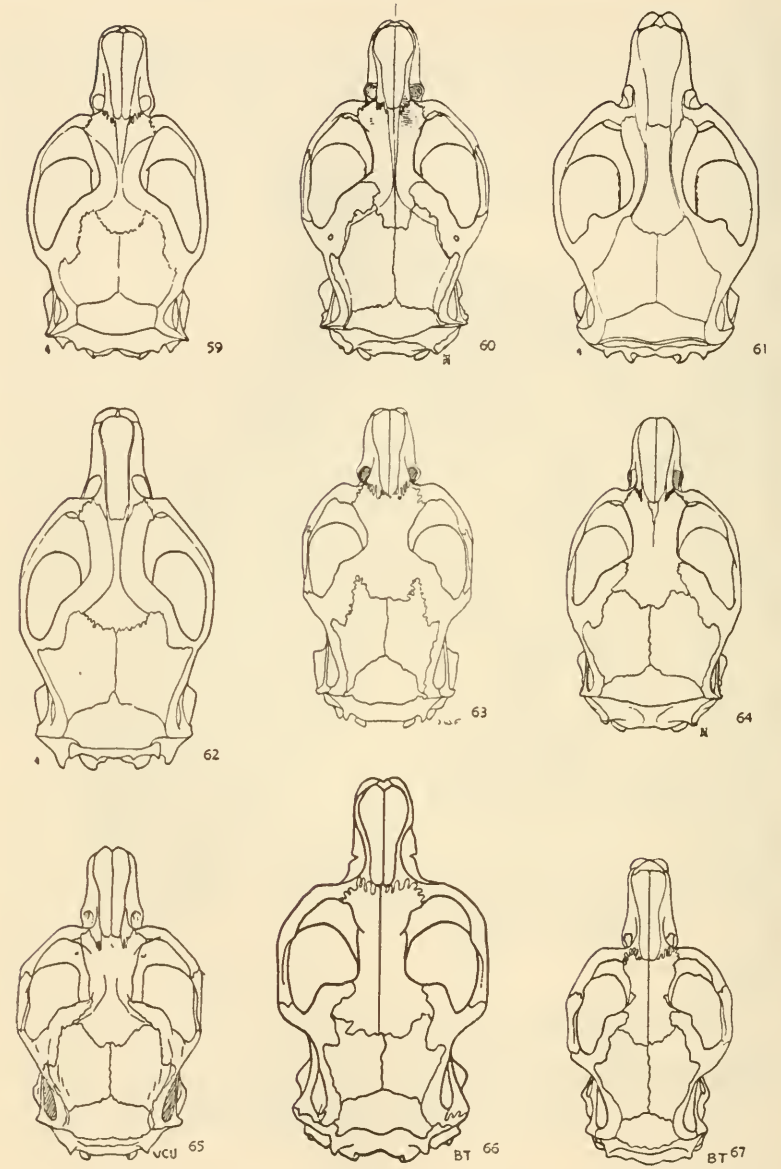


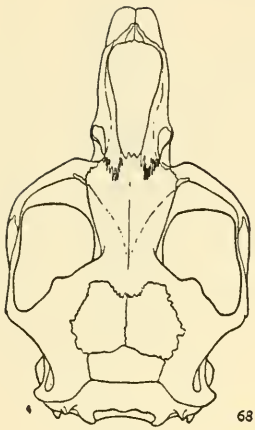
FIG. 58. Distribution of *Neofiber alleni*.

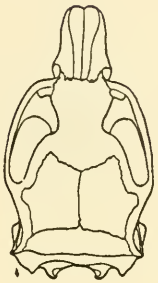
1. *N. a. nigrescens* 2. *N. a. alleni* 3. *N. a. struix*

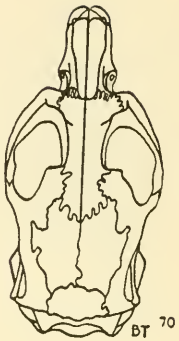


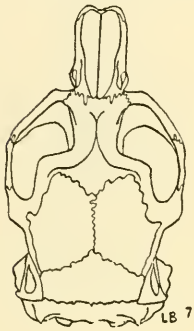
FIGS. 59-67. Dorsal views of skulls of *Microtus*. All × 1½. Other views of these skulls are shown in figs. 95-105.

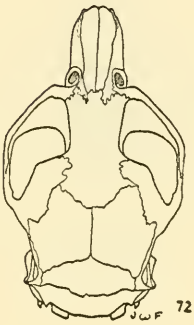
Guide to species
FIG. 59. *M. pennsylvanicus modestus*
FIG. 60. *M. montanus micropus*
FIG. 61. *M. californicus kernensis*
FIG. 62. *M. townsendii townsendii*
FIG. 63. *M. oeconomus macfarlani*
FIG. 64. *M. longicaudus latus*
FIG. 65. *M. mexicanus fundatus*
FIG. 66. *M. xanthognathus*
FIG. 67. *M. chrotorrhinus chrotorrhinus*

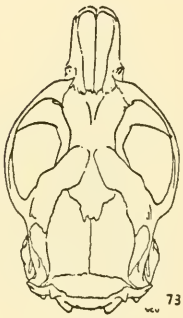


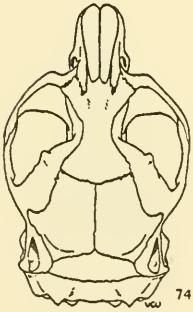


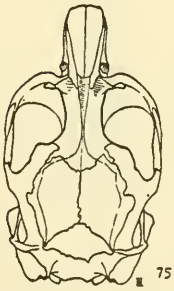


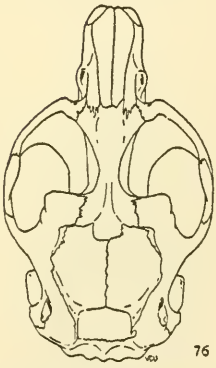






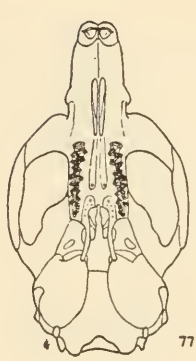


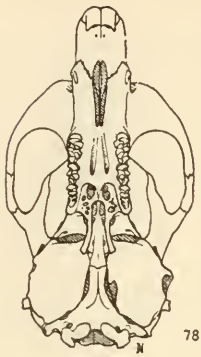


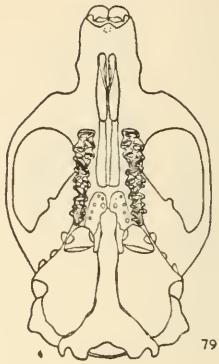


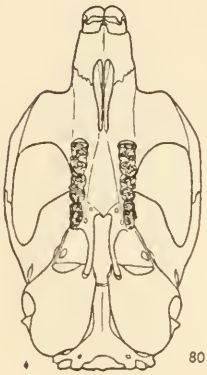
FIGS. 68-76. Dorsal views of skulls of *Microtus*, *Lagurus* and *Neofiber*. Times 1½ except fig. 76, which is natural size. Other views of these skulls are shown in figs. 106-115.

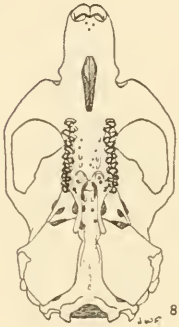
Guide to species
FIG. 68. *M. richardsoni arvicoloides*
FIG. 69. *M. oregoni oregoni*
FIG. 70. *M. miurus muriei*
FIG. 71. *M. guatemalensis*
FIG. 72. *M. umbrosus*
FIG. 73. *M. ochrogaster ochrogaster*
FIG. 74. *M. quasiater*
FIG. 75. *Lagurus c. curtatus*
FIG. 76. *Neofiber a. alleni*

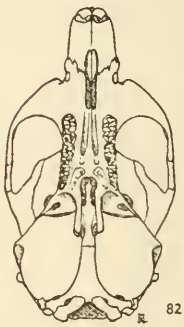


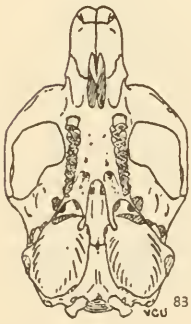


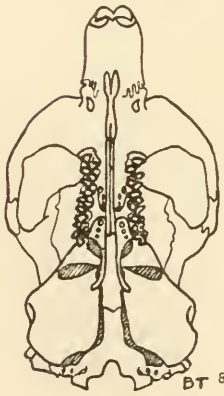


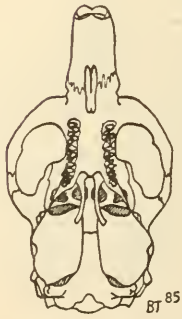








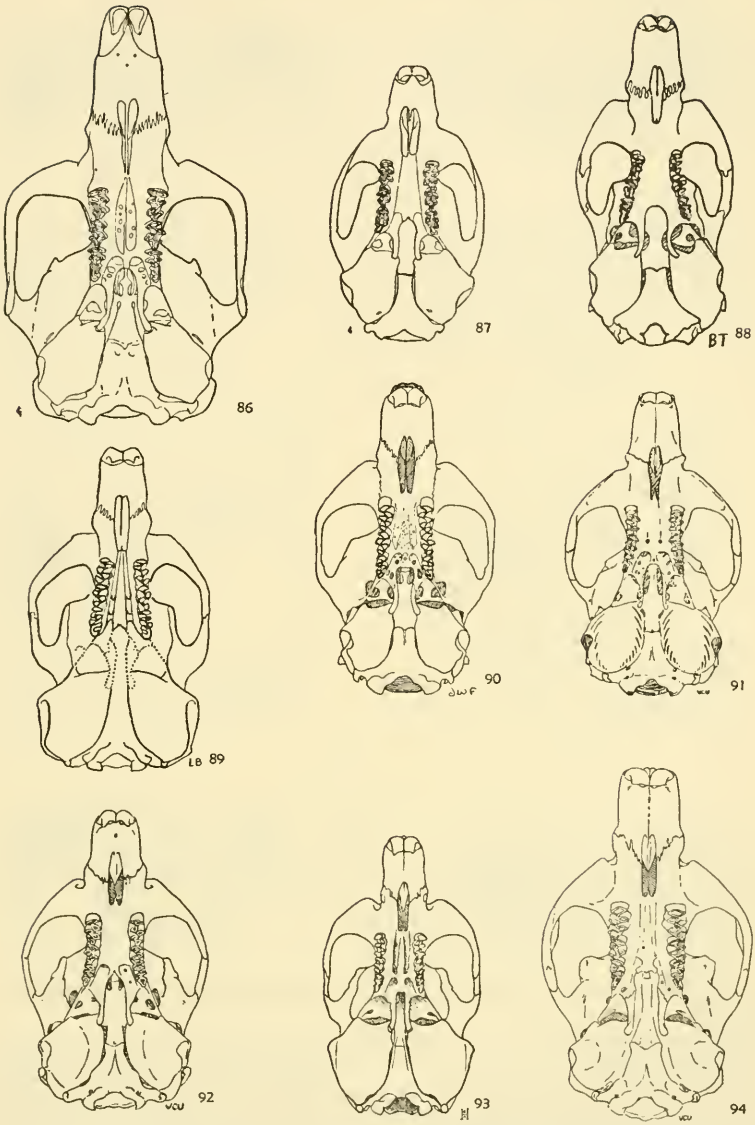




FIGS. 77-85. Ventral views of skulls of *Microtus*. All × 1⅓. Different views of these skulls are shown in figs. 95-105.

Guide to species

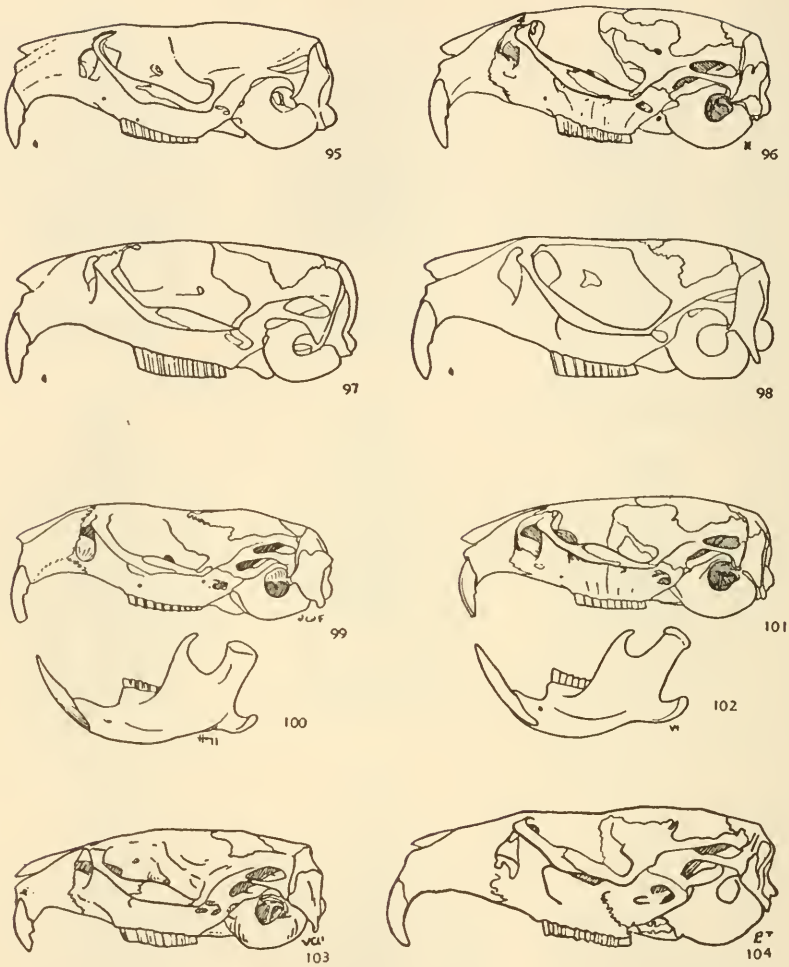
FIG. 77. *M. pennsylvanicus modestus*
FIG. 78. *M. montanus micropus*
FIG. 79. *M. californicus kernensis*
FIG. 80. *M. townsendii townsendii*
FIG. 81. *M. oeconomus macfarlani*
FIG. 82. *M. longicaudus latus*
FIG. 83. *M. mexicanus fundatus*
FIG. 84. *M. xanthognathus*
FIG. 85. *M. chrotorrhinus chrotorrhinus*



FIGS. 86-94. Ventral views of skulls of *Microtus, Lagurus,* and *Neofiber.* Times 1½ except fig. 94, which is natural size. Different views of these skulls are shown in figs. 106-115.

Guide to species

FIG. 86. *M. richardsoni arvicoloides*
FIG. 87. *M. oregoni oregoni*
FIG. 88. *M. miurus muriei*
FIG. 89. *M. guatemalensis*
FIG. 90. *M. umbrosus*
FIG. 91. *M. ochrogaster ochrogaster*
FIG. 92. *M. quasiater*
FIG. 93. *Lagurus c. curtatus*
FIG. 94. *Neofiber a. alleni*



FIGS. 95-104. Lateral views of skulls, some with lower jaws, of *Microtus*. All × 1½.

FIG. 95. *M. pennsylvanicus modestus*, 17 mi. E and 4 mi. N Ashton, Idaho; ♂ 89191 MVZ.

FIG. 96. *M. montanus micropus*, Cleveland Ranch, Nevada; ♂ 46288 MVZ.

FIG. 97. *M. californicus kernensis*, Thompson Canyon, 3900 ft., Walker Basin, Kern Co., California; ♂ 60281 MVZ.

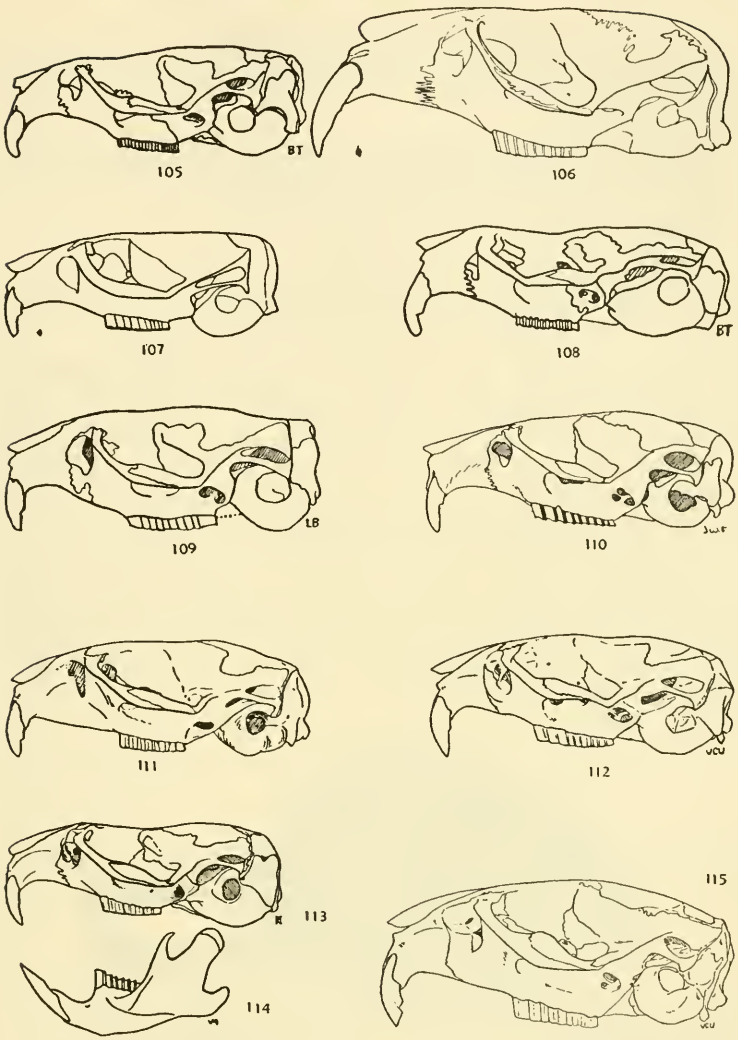
FIG. 98. *M. townsendii townsendii*, 1 mi. N Oregon City, Oregon; ♂ 32484 MVZ.

FIGS. 99-100. *M. oeconomus macfarlani*, N side Salcha River, 600 ft., 25 mi. S and 20 mi. E Fairbanks, Alaska; ♂ 21488 KU.

FIGS. 101-102. *M. longicaudus latus*, Wisconsin Creek, 8500 ft., Nevada; ♀ 45846 MVZ.

FIG. 103. *M. mexicanus fundatus*, 3½ mi. S Pátzcuaro, 7900 ft., Michoacán; ♂ 100637 MVZ.

FIG. 104. *M. xanthognathus*, Fort Smith, Mackenzie; ♂ 109370 USBS.



FIGS. 105-115. Lateral views of skulls of microtine rodents. Times 1½ except fig. 115, which is natural size.

FIG. 105. *Microtus chrotorrhinus chrotorrhinus*, summit of Mt. Washington, New Hampshire; female 150181 USBS.

FIG. 106. *Microtus richardsoni arvicoloides*, Tumalo Creek, 6100 ft., 15 mi. W Bend, Oregon; male 83968 MVZ.

FIG. 107. *Microtus oregoni oregoni*, 1½ mi. S, ½ mi. E Willow Creek, 600 ft., Humboldt Co., California; male 975160 MVZ.

FIG. 108. *Microtus miurus muricl*, Chandler Lake, 68° 12′, 152° 45′, 2900 ft., Alaska; female 43758 KU.

FIG. 109. *Microtus guatemalensis*, Todos Santos, Huehuetenango, Guatemala; male 76767 USBS.

FIG. 110. *Microtus umbrosus*, Mt. Zempoaltepec, 8200 ft., Oaxaca; female 68474 USBS.

FIG. 111. *Microtus ochrogaster ochrogaster*, Lawrence, Douglas Co., Kan.; female 1075 KU.

FIG. 112. *Microtus quasiater*, Teocelo, 4500 ft., Veracruz, female 30706 KU.

FIGS. 113-114. *Lagurus curtatus curtatus*, Chiatovich Creek, 8200 ft., Esmeralda Co., Nevada; male 38731 MVZ.

FIG. 115. *Neofiber alleni alleni*, 1 mi. E Courtenay, Merritt Island, Brevard County, Florida; female 27124 KU.

Genus Ondatra Link—Muskrats

Revised (under name *Fiber*) by N. Hollister, N. Amer. Fauna, 32:1-47, 6 plates, April 29, 1911.

1795. *Ondatra* Link, Beyträge zur Naturgesch., 1(2):76. Type by tautonymy, *Castor zibethicus* Linnaeus (International Commission on Zoological Nomenclature, Nomenclature, opinion 55).
1800. *Fiber* Cuvier, Tabl. Elem. Hist. Nat. Anim., p. 141. Type, *Castor zibethicus* Linnaeus.
1817. *Simotes* Fischer, Mem. Soc. Imp. Nat. Moscow, 5:444. Type, *Mus zibethicus* (= *Castor zibethicus* Linnaeus).
1827. *Moschomys* Billberg, Syn. Faun. Scandinaviae, ed. 1:1, Mamm., Conspectus A (according to Hollister, N. Amer. Fauna, 32:14, April 29, 1911).

Total length, 409-620; tail, 180-295; hind foot, 64-88; weight, 541-1575 grams; basal length of skull, 52.4-65.1; zygomatic breadth, 34.6-44.0. Externally highly modified for aquatic life; tail laterally compressed, relatively long, and more or less naked but with well-developed swimming-fringe below; hind foot much larger than forefoot, with conspicuous swimming-fringes; ears short; fur thick and soft. Mammae 1-2 = 6. Upper parts vary from a bright rusty red through several shades of brown to almost black; sides from bright rusty red to Prout's Brown; venter from whitish to Broccoli Brown with washes of varying intensities of rufous, cinnamon and brownish; feet pinkish gray to dark brown.

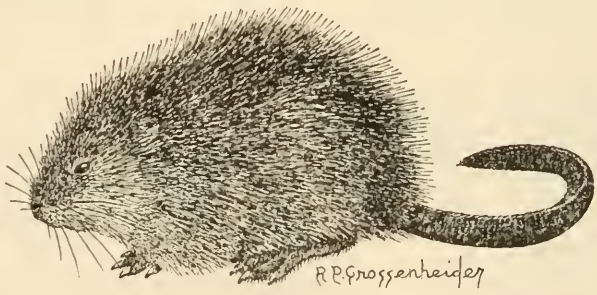


Fig. 116. *Ondatra zibethicus zibethicus*, muskrat, Ann Arbor, Michigan, March 9, 1903. × ¼.

Skull resembling those of *Microtus* and *Neofiber* but larger and more massive. Differs from *Neofiber* in structure of lower molars (m1 with six [not five] triangles between anterior loop and posterior loop; first one of six triangles not closed; anterior loop bilobed and with deep re-entrant angles; m3 with three [not 2] outer salient angles).

KEY TO THE NOMINAL SPECIES OF THE GENUS ONDATRA

1. Upper parts averaging lighter than dark mummy brown; basal length of skull averaging more than 54 mm.; not in Newfoundland. *O. zibethicus*, p. 465

1'. Upper parts dark mummy brown to black; basal length of skull averaging less than 54 mm.; native to Newfoundland only . . . . . *O. obscurus*, p. 470

Ondatra zibethicus

Muskrat

Measurements and description are as given in the account of the genus. The muskrat breeds at any time of the year in the southern part of its range; farther northward the breeding season is from April to August. Two litters per year are usually obtained from pen-raised animals. The litter-size varies from one to 11 and averages 6.5.

The muskrat has been introduced into many areas where it did not occur naturally. Some of these introductions have been deliberate; others have been accidental—escapes from fur farms. Storer (1937:443-460) has listed several known introductions in California and on several islands off the coast of British Columbia. Newsom (1937:437) reported that muskrats have been introduced on Anticosti Island in the Gulf of St. Lawrence. So far as we know, this is the only American microtine that has become established in Eurasia; the muskrat now occurs at many places in Europe and in northern Asia.

The muskrat is the most important furbearer in North America. That is to say, trappers receive more dollars for muskrat pelts than they do for the pelts of any other one kind of furbearer. See figure 2, page 377.

ONDATRA ZIBETHICUS ALBUS (Sabine).

1823. *Fiber zibethicus—albus* Sabine, Franklin's Narrative, Journey to Polar Sea, p. 660, type from Cumberland House, Saskatchewan.
1912. *Ondatra zibethica alba*, Miller, Bull. U. S. Nat. Mus., 79:231, December 31.
1902. *Fiber zibethicus hudsonius* Preble, N. Amer. Fauna, 22:53, October 31, type from Fort Churchill, Keewatin.

Marginal records (Hollister, 1911:21).—Manitoba: Fort Churchill; York Factory; Echimamish River; The Pas. Saskatchewan: type locality.

ONDATRA ZIBETHICUS AQUILONIUS (Bangs).

1899. *Fiber zibethicus aquilonius* Bangs, Proc. New England Zool. Club, 1:11, February 28, type from Rigolet, Hamilton Inlet, Labrador.
1912. *Ondatra zibethica aquilonia*, Miller, Bull. U. S. Nat. Mus., 79:230, December 31.

Marginal records.—Quebec: [Ungava] Forks (Hollister, 1911:20); thence around coast to: Kecarpoui (Weaver, 1940:421).

ONDATRA ZIBETHICUS BERNARDI Goldman.

1932. *Ondatra zibethica bernardi* Goldman, Proc. Biol. Soc. Washington, 45:93, June 21, type from 4 mi. S Gadsden, Yuma Co., Arizona.

Marginal records.—Nevada: Colorado River, Durban Ranch, 14 mi. E Searchlight (Hall, 1946:569). Arizona: Topock (Goldman, 1932:94); type locality. Baja California: 15 mi. S Volcano Lake (Goldman, 1932:94). California: Calipatria (*ibid.*).

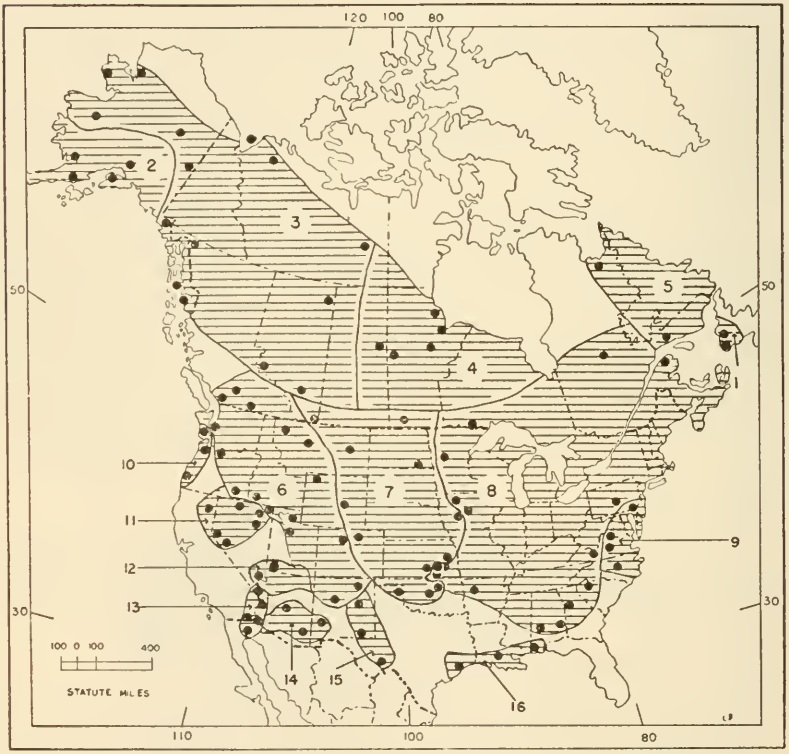


FIG. 117. Distribution of *Ondatra zibethicus* and *O. obscurus*.

Guide to kinds
1. *O. obscurus*
2. *O. z. zalophus*
3. *O. z. spatulatus*
4. *O. z. albus*
5. *O. z. aquilonius*
6. *O. z. osoyoosensis*
7. *O. z. cinnamominus*
8. *O. z. zibethicus*
9. *O. z. macrodon*
10. *O. z. occipitalis*
11. *O. z. mergens*
12. *O. z. goldmani*
13. *O. z. bernardi*
14. *O. z. pallidus*
15. *O. z. ripensis*
16. *O. z. rivalicius*

ONDATRA ZIBETHICUS CINNAMOMINUS (Hollister).

1910. *Fiber zibethicus cinnamominus* Hollister, Proc. Biol. Soc. Washington, 23:125, September 2, type from Wakeeney, Trego Co., Kansas.
1912. *Ondatra zibethica cinnamomina*, Miller, Bull. U. S. Nat. Mus., 79:232, December 31.

Marginal records (Hollister, 1911:31, unless otherwise noted).—Manitoba: Carberry. North Dakota: Oaks [= Oakes]. Iowa: Knoxville (Scott, 1937:79). Kansas (Cockrum, 1952:198): 6 mi. SW Garnett; Halstead. Oklahoma (Blair, 1939:127): 2 mi. N Dawson; Norman. Texas: Canadian. Colorado: Ward. Wyoming: Sun. Montana: Little Dry Creek. Alberta: Lodge Creek (Soper, 1946:148).

ONDATRA ZIBETHICUS GOLDMANI Huey.

1938. *Ondatra zibethica goldmani* Huey, Trans. San Diego Soc. Nat. Hist., 8(32):409, January 18, type from Saint George, Washington Co., Utah.

Marginal records.—Utah (Durrant, 1952:360): Orderville. Nevada: Muddy Creek near St. Thomas (Hall, 1946:568).

ONDATRA ZIBETHICUS MACRODON (Merriam).

1897. *Fiber macrodon* Merriam, Proc. Biol. Soc. Washington, 11:143, May 13, type from Lake Drummond, Dismal Swamp, Norfolk Co., Virginia.
1912. *Ondatra zibethica macrodon,* Miller, Bull. U. S. Nat. Mus, 79:230, December 31.
1911. *F[iber]. niger* Brass, Aus dem Reiche der Pelze, p. 604, type locality in New Jersey or Delaware.

Marginal records (Hollister, 1911:19, unless otherwise noted).—Pennsylvania: Chester County, thence east to coast and down coast into North Carolina: Raleigh (Handley and Patton, 1947:177). Virginia: Nelson County (*op. cit.* :176); Washington. Maryland: *Jefferson.*

ONDATRA ZIBETHICUS MERGENS (Hollister).

1910. *Fiber zibethicus mergens* Hollister, Proc. Biol. Soc. Washington, 23:1, February 2, type from Fallon, Churchill Co., Nevada.
1912. *Ondatra zibethica mergens,* Miller, Bull. U. S. Nat. Mus., 79:231, December 31.

Marginal records.—Nevada: Paradise (Hollister, 1911:28); Marys River, 22 mi. N Deeth, 5000 ft. (Hall, 1946:567); W side Ruby Lake, 3 mi. N White Pine Co. line, 6200 ft. (*ibid.*); 20 mi. S Schurz, W side Walker Lake (*ibid.*); Carson River, 5 mi. SE Minden, 4900 ft. (*ibid.*). California: Lake Tahoe (Grinnell, 1933:192); Eagle Lake (*ibid.*).

ONDATRA ZIBETHICUS OCCIPITALIS (Elliot).

1903. *Fiber occipitalis* Elliot, Field Columb. Mus. Publ. 74, zool. ser., 3:162, May 2, type from Florence, Lane Co., Oregon.
1912. *Ondatra zibethica occipitalis,* Miller, Bull. U. S. Nat. Mus., 79:231, December 31.

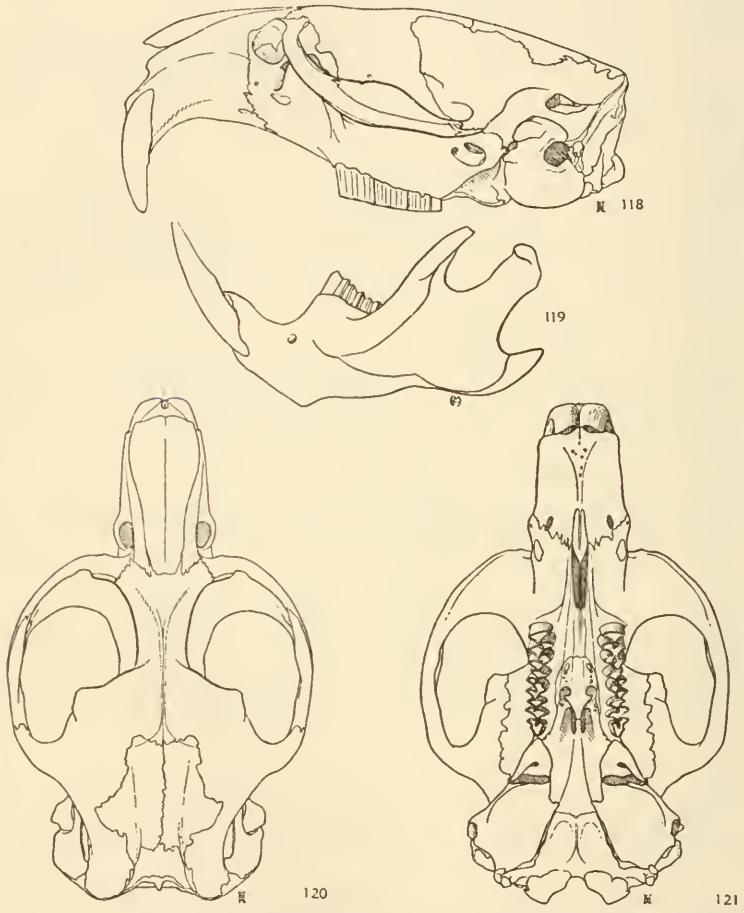
Marginal records.—Washington: Aberdeen (Dalquest, 1948:363). Oregon: Portland (Hollister, 1911:27); Coquille (Bailey, 1936:218).

ONDATRA ZIBETHICUS OSOYOOSENSIS (Lord).

1863. *Fiber osoyoosensis* Lord, Proc. Zool. Soc. London, p. 97, October, type from Lake Osoyoos, British Columbia.
1912. *Ondatra zibethica osoyoosensis,* Miller, Bull. U. S. Nat. Mus., 79:231, December 31.

Marginal records (Hollister, 1911:26, unless otherwise noted).—British Columbia: Ashcroft; Kettle River. Montana: Summit; Highwood Mts. Wyoming: Valley. Colorado: Hot Sulphur Springs. New Mexico: 3 mi. SE

Cimarron (Hill, 1942:81); Albuquerque (Bailey, 1932:207). Utah: Utah Lake (Durrant, 1952:359); Ogden. Nevada: Goose Creek, 2 mi. W Utah boundary, 5000 ft. (Hall, 1946:567). Idaho: S fork Owyhee River, 12 mi. N Nevada line (Davis, 1939:330). Oregon: Shirk, W of Steens Mts. (Bailey, 1936:215); The Dalles. Washington: Tenino (Dalquest, 1948: 363). British Columbia: Port Moody.



Figs. 118-121. Skull and lower jaw of *Ondatra zibethicus mergens*, muskrat, 10 mi. SE Fallon, Nevada; ♂ 90544 MVZ. × 1.

Ondatra zibethicus pallidus (Mearns).

1890. *Fiber zibethicus pallidus* Mearns, Bull. Amer. Mus. Nat. Hist., 2:280, February 21, type from Fort Verde, Yavapai Co., Arizona.
1912. *Ondatra zibethica pallida*, Miller, Bull. U. S. Nat. Mus., 79:232, December 31.

Marginal records (Hollister, 1911:29).—Arizona: type locality. New Mexico: Upper Tularosa River. Arizona: Camp Grant.

ONDATRA ZIBETHICUS RIPENSIS (Bailey).

1902. *Fiber zibethicus ripensis* Bailey, Proc. Biol. Soc. Washington, 15:119, June 2, type from Eddy, near Carlsbad, Eddy Co., New Mexico.
1912. *Ondatra zibethica ripensis*, Miller, Bull. U. S. Nat. Mus., 79:232, December 31.

Marginal records (Hollister, 1911:30).—New Mexico: Santa Rosa. Texas: Fort Stockton. New Mexico: Carlsbad.

ONDATRA ZIBETHICUS RIVALICIUS (Bangs).

1895. *Fiber zibethicus rivalicius* Bangs, Proc. Boston Soc. Nat. Hist., 26:541, July 31, type from Burbridge, Plaquemines Parish, Louisiana.
1940. *Ondatra z[ibethicus]. rivalicius*, Davis and Lowery, Jour. Mamm., 21:212, May 16.

Marginal records.—Alabama: Three-mile Creek, near Mobile (Howell, 1921:57). Texas: 2 mi. SW Pasadena (Davis and Lowery, 1940:213). Louisiana: Pointe Coupee Parish (Lowery, 1936:30).

ONDATRA ZIBETHICUS SPATULATUS (Osgood).

1900. *Fiber spatulatus* Osgood, N. Amer. Fauna, 19:36, October 6, type from Lake Marsh, Yukon.
1912. *Ondatro zibethica osoyoosensis*, Miller, Bull. U. S. Nat. Mus., 79:231, December 31.

Marginal records (Hollister, 1911:23, unless otherwise noted).—Mackenzie District: Richards Island (Anderson, 1947:165); Fort Anderson; Fort Reliance (Banfield, 1951:119). Alberta: Athabaska Lake; Blindman River; Henry House. Alaska: Portage Cove, Revillagigedo Island; Sergief Island (Swarth, 1922:179). British Columbia: Bennett. Alaska: Anklin River, Yakutat Bay; Eagle; Fort Hamlin; Russian Mission, Yukon River; Nome; Kobuk Valley (Bailey and Hendee, 1926:21).

ONDATRA ZIBETHICUS ZALOPHUS (Hollister).

1910. *Fiber zibethicus zalophus* Hollister, Proc. Biol. Soc. Washington, 23:1, February 2, type from Becharof Lake, Alaska Peninsula, Alaska.
1912. *Ondatra zibethica zalophus*, Miller, Bull. U. S. Nat. Mus., 79:231, December 31.

Marginal records.—Alaska: Knik Valley (Wilber, 1946:216); Fort Kenai (Hollister, 1911:24); Ugashik (*ibid.*); Nushagak (*ibid.*).

ONDATRA ZIBETHICUS ZIBETHICUS (Linnaeus).

1766. *[Castor] zibethicus* Linnaeus, Syst. Nat., ed. 12, 1:79, type from eastern Canada.
1795. *[Ondatra] zibethicus*, Link, Beyträge zur Naturgesch., 1(2):76.
1808. *Ondatra americana* Tiedemann, Zoologie, 1:481 (new name for *M. zibethicus* Schreber and *Castor zibethicus* Linnaeus).
1829. *Fiber zibethicus*, var. B, *nigra* Richardson, Fauna Boreali-Amer., 1:119 (no definite locality).
1829. *Fiber zibethicus*, var. C, *maculosa* Richardson, Fauna Boreali-Amer., 1:119 (no definite locality).
1867. *Fiber zibethicus varius* Fitzinger, Sitz.-Ber. kais. Akad. Wiss., 56:47 (new name for *F. z. maculosa* Richardson).
1867. *Fiber zibethicus niger* Fitzinger, Sitz.-Ber. kais. Akad. Wiss., 56:47 (new name for *F. z. nigra* Richardson).

Marginal records.—Quebec: Lake Nichikun, N of Lake Mistassini (Cameron and Morris, 1951:128); Ste. Anne de Monts (Goodwin, 1924:255), thence along coast to New Jersey. Pennsylvania: Carlisle (Hollister, 1911:18). Virginia: Blacksburg (Patton, 1939:77). South Carolina: Greenville (Hollister, 1911:18). Georgia: Hogansville (*ibid.*). Alabama (Howell, 1921:56): Seale; Coffeeville. Arkansas: Ozark (Black, 1936:34). Kansas (Cockrum, 1952:199): Arkansas City; Hamilton; Neosho Falls. Iowa (Scott, 1937:79): Ames; Burlington. Minnesota: S end Ten Mile Lake (Leraas, 1942:344). Ontario: Quetico Park (Cahn, 1937:27).

Ondatra obscurus (Bangs)

Newfoundland Muskrat

1894. *Fiber obscurus* Bangs, Proc. Biol. Soc. Washington, 9:133, September 15, type from Codroy, Newfoundland.
1912. *Ondatra obscura*, Miller, Bull. U. S. Nat. Mus., 79:230, December 31.

Marginal records (Hollister, 1911:15).—Newfoundland: Bay St. George; type locality.

Average measurements of seven adults are: Total length, 500; tail, 226; hind foot, 76; basal length of skull, 53.2; zygomatic breadth, 34.7. This insular species differs from *O. zibethicus* in smaller, "weaker" skull, large parietals and larger (in relation to size of the animal) hind foot.

Genus Lemmus Link—Lemmings

American forms revised by W. B. Davis, Murrelet, 25:19-25, September 19, 1944.

1795. *Lemmus* Link, Beyträge zur Naturgesch., 1(2):75. Type, *Mus lemmus* Linnaeus.

Total length, 120-160; tail, 18-26; hind foot, 18-23; weight up to 113 grams; basal length, 28.8-31.4; zygomatic breadth, 19.7-22.0. Pelage long, with much reddish; form heavy, thickset; plantar pads vestigial; sole heavily haired; legs short; tail not projecting beyond hind feet in study skins; ear much reduced; mammae 2-2 = 8. Skull exceptionally massive, with extreme of interorbital constriction; temporal ridges fused into sharp median interorbital crest; zygomata widely divergent; tooth-rows widely divergent posteriorly; tympanic bullae large, outer salient angles and infolds deeper on outer than inner side of upper molars and deeper on inner, than on outer, side of lower teeth.

Key to the Nominal Species of Lemmus

1. Pelage short (15-18 mm. on rump); hind feet black; auditory bullae small (8 x 6 mm.) ..... *L. nigripes*, p. 471
1′. Pelage long (26-28 mm. on rump); hind feet whitish; auditory bullae large (10 x 7 mm.) ..... *L. trimucronatus*, p. 471

Lemmus nigripes (True)

Black-footed Lemming

1894. *Myodes nigripes* True, Diagnoses of new North American mammals, p. 2, April 24 (reprinted in Proc. U. S. Nat. Mus., 17:242, November 15, 1894), type from St. George Island, Pribilof Islands, Alaska. Known only from type locality except as introduced on St. Paul Island (see O'Malley, Science, N. S., 63:596, June 11, 1926).
1896. *L[emmus]. nigripes,* Miller, N. Amer. Fauna, 12:37, July 23.

Average external measurements of five females and two males, respectively, are: total length, 140, 153; tail, 26, 20; hind foot, 20.5, 21.5. Upper parts with less difference in color between anterior and posterior areas than in *L. trimucronatus,* at least in summer pelage, and pelage shorter, both in winter and summer; hind feet black in all known specimens, in all seasons and at all ages; tympanic bullae smaller than in *L. trimucronatus.*

Lemmus trimucronatus

Brown Lemming

Total length, 122-160; tail, 18-23; hind foot, 18-23; ear, 8-11; weight of adult males, of *L. t. alascensis* from northern Alaska, up to 113 grams. Upper parts anteriorly grizzled grayish (summer) to grizzled tawny (winter); rump varying from dark chestnut to

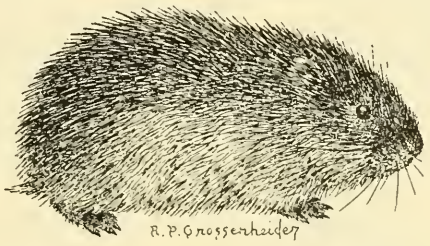


Fig. 122. *Lemmus trimucronatus alascensis,* brown lemming, Kaolak, 69° 56′, 160° 15′, 152 ft., Alaska, July 26, 1951; ♀ 43299 KU. × ½.

rusty or burnt umber (summer) and from tawny to fulvous (winter); sides varying from light ochraceous-buff to cinnamon (summer) and from fuscous to cinnamon (winter); underparts washed with buff. The number of embryos for 12 females from northern Alaska averaged 7.3 (4-11).

Lemmus trimucronatus alascensis Merriam.

1900. *Lemmus alascensis* Merriam, Proc. Washington Acad. Sci., 2:26, March 14, type from Point Barrow, Alaska.
1843. ?*Myodes albigularis* Wagner, Schreber's Säugethiere Suppl., p. 602, according to Hinton (Monograph of the voles and lemmings . . ., 1926, p. 207) may be from the NW coast of North America. If identifiable, this name may apply to *Lemmus.*

1900. *Lemmus yukonensis* Merriam, Proc. Washington Acad. Sci., 2:27, March 14, type from Charlie Creek, Yukon River, Alaska.

1937. *Lemmus trimucronatus alascensis,* Anderson, Mammals and birds of the western Arctic district, Northwest Territories, Canada, p. 110, *in* Canada's Western Northland, Dept. Mines and Resources, Ottawa, July 9. *Lemmus sibiricus* may replace *Lemmus trimucronatus* as the name of the species; *Lemmus sibiricus chrysogaster* (see Ellerman and Morrison-Scott, Checklist of Palaearctic and Indian mammals, 1758-1946, Publ. British Museum (Nat. Hist.), p. 656, November 19, 1951) and *Lemmus trimucronatus alascensis* are regarded as related by Ognev (The mammals of Russia (U. S. S. R.) and adjacent countries, Publ. Acad. Sci. U. S. S. R., Vol. 6, p. 470, 1948).

Marginal records (unless otherwise indicated, Davis, 1944:22).—Alaska: type locality. Mackenzie District: Baillie Island, Cape Bathurst. Yukon: near mouth Russell Creek (Osgood, 1909:80); Rink Rapids (Osgood, 1900: 37). Alaska: Charlie Creek (*ibid.*); head Toklat River; Hooper Bay; Grantley Harbor.

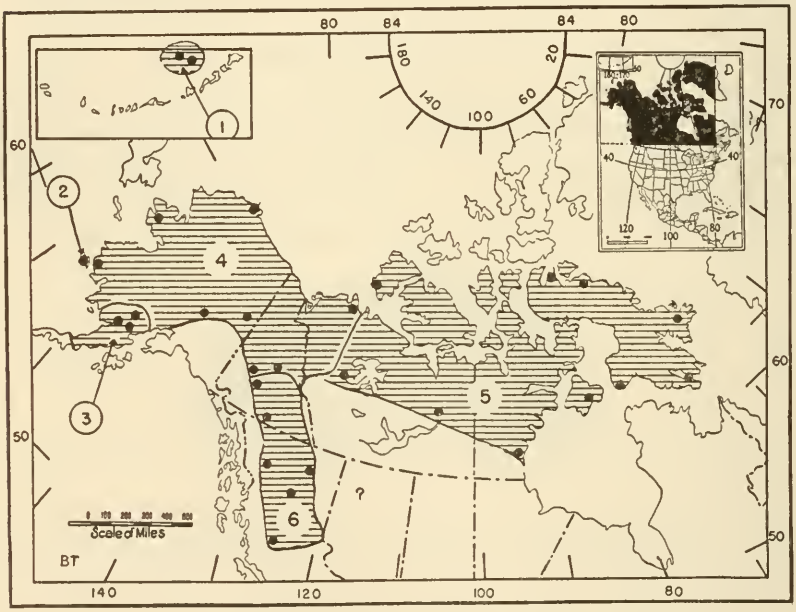


FIG. 123. Distribution of *Lemmus trimucronatus* and *L. nigripes.*

1. *Lemmus nigripes*
2. *L. t. harroldi*
3. *L. t. minusculus*
4. *L. t. alascensis*
5. *L. t. trimucronatus*
6. *L. t. helvolus*

LEMMUS TRIMUCRONATUS HARROLDI Swarth.

1931. *Lemmus harroldi* Swarth, Proc. Biol. Soc. Washington, 44:101, October 17, type from Nunivak Island, Alaska. Known from type locality only.

1944. *Lemmus trimucronatus harroldi,* Davis, Murrelet, 25:23, September 19.

Lemmus trimucronatus helvolus (Richardson).

1828. *Arvicola* (*Lemmus*) *helvolus* Richardson, Zool. Jour., 3:517, type from near the headwaters of one of the southern tributaries of Peace River, or between there and Jasper House region, Alberta (Preble, N. Amer. Fauna, 27:182, October 26, 1908).
1944. *Lemmus trimucronatus helvolus*, Davis, Murrelet, 25:22, September 19.

Marginal records.—Yukon: Tantalus (Anderson, 1947:147). British Columbia: Laurier Pass (Sheldon, 1932:200); Sustut Mts., 25 mi. SE Thudade Lake (Davis, 1944:22). *Alberta:* ? "*Rocky Mountain region of northwestern Alberta*" (Anderson, 1947:147). British Columbia: Stuie (*ibid.*); Telegraph Creek (Davis, 1944:22). Yukon: Teslin Lake (Anderson, 1947:147).

Lemmus trimucronatus minusculus Osgood.

1904. *Lemmus minusculus* Osgood, N. Amer. Fauna, 24:36, November 23, type from Kakhtul River, near its junction with the Malchatna River, Alaska.
1944. *Lemmus trimucronatus minusculus*, Davis, Murrelet, 25:23, September 19.

Marginal records (Davis, 1944:23).—Alaska: Upper Forks Chalitna River; type locality; Nushagak River near Kakwok.

Lemmus trimucronatus trimucronatus (Richardson).

1825. *Arvicola trimucronata* Richardson, Jour. Parry's Second Voyage, app., p. 309, type from Point Lake, Mackenzie District.
1900. *Lemmus trimucronatus*, Stone, Proc. Acad. Nat. Sci. Philadelphia, p. 35, March 24.

Marginal records (Davis, 1944:20, unless otherwise noted).—Franklin District: Baffin Island: Strathcona Sound (Anderson, 1947:147); Pond Inlet (*ibid.*); Pangnirtung Fjord; Bishop Island, Frobisher Bay; Cape Dorset. Keewatin District: Coral Harbor, Southampton Island; 50 mi. S Cape Eskimo. Mackenzie District: Artillery Lake (Anderson, 1937:110); Fort Franklin (Preble, 1908:181). Franklin District: Cape Kellett, Banks Island.

Genus Synaptomys Baird—Bog Lemmings

Revised by A. B. Howell, N. Amer. Fauna, 50:ii+38, August 5, 1927.

1858. *Synaptomys* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 558, July 14. Type, *Synaptomys cooperi* Baird.

Total length, 118-154; tail, 16-27; hind foot, 16-24; basal length of skull, 22-26; zygomatic breadth, 15.0-17.7. Pelage long and loose; tail averaging slightly longer than hind foot; soles of feet not heavily haired; plantar pads 6; mammae 6 or 8. Supraorbital ridges forming median interorbital crest in adult; squamosal crests well developed; rostrum thick and short (less than 25 per cent of total length of skull); tympanic bullae large; upper incisors broad and prominently grooved; molars rootless, with persistent pulp; roots of mandibular incisors on lingual sides of molars; re-entrant angles excessively

deep on buccal sides of upper molars and on lingual sides of lower molars; M3 with four simple, transverse loops, peculiarly arranged; external form not highly specialized.

Key to the Species of Synaptomys

1. No hairs at base of ears appreciably brighter than remainder of pelage; mammae 6; mandibular molars with triangles on outer side; palate with broad, blunt median projection ..... S. *cooperi*, p. 474
1'. A few hairs at base of ears distinctly brighter (with bright rusty tinge) than remainder of pelage; mammae 8; mandibular molars without triangles on outer side; palate with sharply pointed median projection pointed backward ..... S. *borealis*, p. 477

Subgenus SYNAPTOMYS Baird

1858. *Synaptomys* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 558, July 14. Type, *Synaptomys cooperi* Baird.

Mandibular molars with closed triangles on outer sides; outer reentrant angles well developed; mandibular incisors heavy, outer edges never noticeably unworn or prolonged into sharp splinters of enamel; palate with poorly developed posterior spinous process; no hairs at base of ears appreciably brighter than remainder of pelage; mammae 1-2 = 6.

Fig. 124. *Synaptomys cooperi gossii*, bog lemming, 3 mi. N and 1 mi. E Sharon, Barber Co., Kansas, March 11, 1951; ♀ 40184 KU. × ½

Synaptomys cooperi

Bog Lemming

Total length, 118-154; tail, 13-24; hind foot, 16-24; ear, 8-14; weight, 21.4-50 grams. Upper parts varying from bright cinnamon to sayal brown, often heavily suffused with black; underparts plumbeous; for additional characters see account of subgenus. Nine females from Kansas had an average of 3.5 (1-7) embryos; the mode was 3.

Synaptomys cooperi cooperi Baird.

1858. *S[ynaptomys]. cooperi* Baird, Repts. Expl. and Surv. . . ., pt. 1, Mammals, p. 558, July 14, type locality fixed by Bole and Moulthrop (1942:146) at Jackson, Carroll Co., New Hampshire.

1896. *Synaptomys fatuus* Bangs, Proc. Biol. Soc. Washington, 10:47, March 9, type from Lake Edward, Quebec.

Marginal records.—Quebec: Ste. Marguerite River (Anderson, 1947:144). New Brunswick: near Bathurst (A. B. Howell, 1927:14). Nova Scotia: Cape Breton Island (Anderson, 1947:144); Digby (Smith, 1940:233). New Hampshire: Durham (Eadie, 1937:102). Connecticut: Macedonia [State Park, near], Kent (Goodwin, 1935:127). Pennsylvania: Deephollow Run, 1800 ft., between La Porte and Nordmont (Green, 1930:16). New York: Alfred Center (A. B. Howell, 1927:14). Ohio (Bole and Moulthrop, 1942:148): Auburn Corners; Adams Mills; Smoky Creek. Michigan: Ann Arbor (A. B. Howell, 1927:14); Newago County (Burt, 1946:213). Wisconsin: Lakewood (A. B. Howell, 1927:14); Solon Springs (Cory, 1912: 238). Minnesota: Elk River (A. B. Howell, 1927:14); Roseau County (Swanson, 1945:89). Manitoba (Anderson, 1947:144): near Dawson, Sandilands Forest Reserve; *Pine Falls on Winnepeg River.* Ontario (Anderson and Rand, 1943A:103): Lake Nipigon; Franz. Quebec: Lake Mistassini (Cameron and Morris, 1951:127).

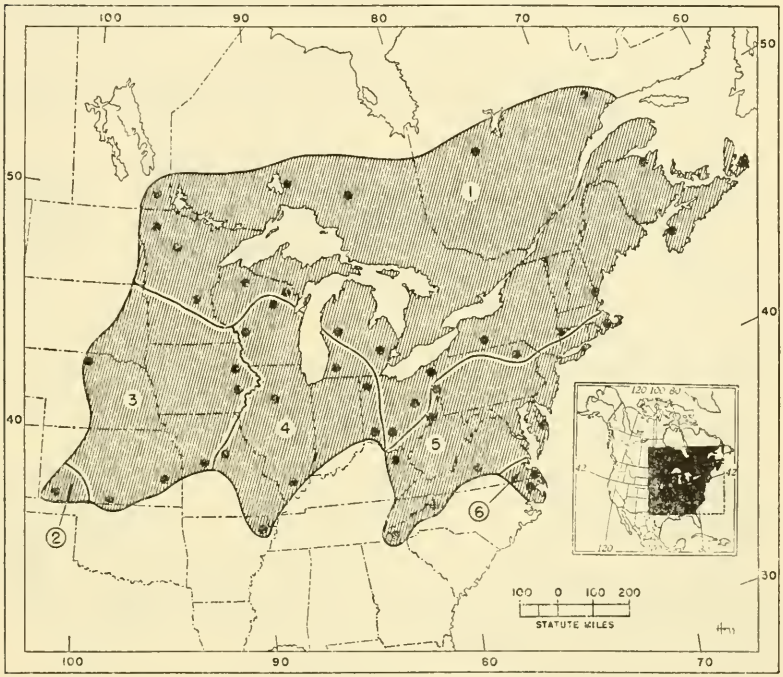


FIG. 125. Distribution of *Synaptomys cooperi.*

1. *S. cooperi cooperi*
2. *S. cooperi paludis*
3. *S. cooperi gossii*
4. *S. cooperi saturatus*
5. *S. cooperi stonei*
6. *S. cooperi helaletes*

SYNAPTOMYS COOPERI GOSSII (Coues).

1877. *Arvicola* (*Synaptomys*) *gossii* Coues, Monogr. N. Amer. Rodentia, p. 235 (published as synonym of *Synaptomys cooperi*, but name stated to apply to Kansan specimens, description and measurements of which are printed on p. 236), type from Neosho Falls, Woodson Co., Kansas.

1897. *Synaptomys cooperi gossii*, Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 49:307, June.

Marginal records.—Nebraska: Niobrara Game Preserve near Valentine (Fichter and Hansen, 1947:1). Iowa: Marion (A. B. Howell, 1927:19); Fairport (Scott, 1937:76, *fide* Hall and Cockrum, 1952:297). Missouri: 4 mi. NW Sedalia (17631 KU). Kansas: type locality; 3 mi. N, 1 mi. E Sharon (40184 KU).

Synaptomys cooperi helaletes Merriam.

1896. *Synaptomys helaletes* Merriam, Proc. Biol. Soc. Washington, 10:59, March 19, type from Dismal Swamp, Norfolk Co., Virginia.
1927. *Synaptomys cooperi helaletes*, A. B. Howell, N. Amer. Fauna, 50:9, August 5.

Marginal records (A. B. Howell, 1927:17).—Virginia: Lake Drummond. North Carolina: Chapanoke.

Synaptomys cooperi paludis Hibbard and Rinker.

1942. *Synaptomys cooperi paludis* Hibbard and Rinker, Univ. Kansas Sci. Bull., 28:26, May 15, type from Meade County State Park, Meade Co., Kansas. Known from type locality only.

Synaptomys cooperi saturatus Bole and Moulthrop.

1942. *Synaptomys cooperi saturatus* Bole and Moulthrop, Sci. Publs. Cleveland Mus. Nat. Hist., 5:149, September 11, type from Bloomington, McLean Co., Illinois.

Marginal records.—Wisconsin: Kelly Lake (Hall and Cockrum, 1952:296). Michigan: Cassopolis (*ibid.*). Ohio (Bole and Moulthrop, 1942:151): Evansport; Chilo. Illinois: Rosiclare (Hall and Cockrum, 1952:296). Arkansas: Lake City (*ibid.*). Missouri: near Midway (Fisher, 1946:436). Illinois: type locality. Wisconsin: Camp Douglas (A. B. Howell, 1927:16, *fide* Hall and Cockrum, 1952:296).

Synaptomys cooperi stonei Rhoads.

1893. *Synaptomys stonei* Rhoads, Amer. Nat., 27:53, January, type from May's Landing (on Egg River), Atlantic Co., New Jersey.
1897. *Synaptomys cooperi stonei*, Rhoads, Proc. Acad. Nat. Sci. Philadelphia, 49:305, June.

Marginal records.—Massachusetts: Wareham (A. B. Howell, 1927:16). Maryland: Pocomoke River, 6 mi. SW Snow Hill (Poole, 1943:103). Virginia: Campbell County (A. B. Howell, 1927:16). North Carolina: Magnetic City (A. B. Howell, 1927:16); Highlands (Odum, 1948A:74). Kentucky: near Morehead State Teachers College (Welter and Sollberger, 1939: 81). Ohio (Bole and Moulthrop, 1942:149): Cat Run; Lisbon.

Subgenus MICTOMYS True

1894. *Mictomys* True, Diagnoses of new North American Mammals, p. 2, April 26 (reprinted in Proc. U. S. Nat. Mus., 17:242, November 15). Type, *Mictomys innuitus* True.

Mandibular molars without closed triangles on outer sides, and almost no outer re-entrant angles; mandibular incisors relatively slender and sharply pointed; palate with well-developed spinous process behind; few hairs at bases of ears appreciably brighter than remainder of pelage. Mammae 2-2 = 8.

Synaptomys borealis

Northern Bog Lemming

Total length, 118-135; tail, 19-27; hind foot, 16-22; ear, 12-13; weight, 32-34 grams (2 individuals). Upper parts varying from grizzled gray to Brussels brown, with admixture of black hairs; underparts plumbeous; tail bicolored; feet grayish to almost black; for additional characters see account of subgenus.

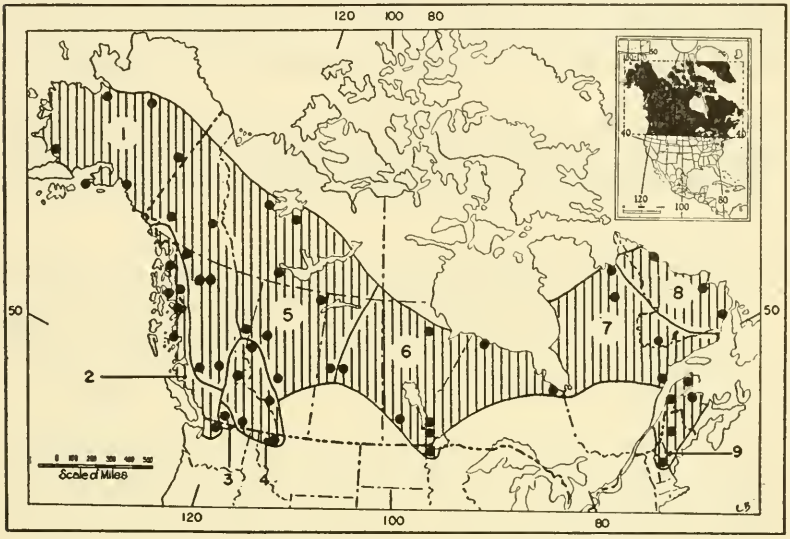


FIG. 126. Distribution of *Synaptomys borealis*.

1. *S. b. dalli*
2. *S. b. wrangeli*
3. *S. b. artemisiae*
4. *S. b. chapmani*
5. *S. b. borealis*
6. *S. b. smithi*
7. *S. b. innuitus*
8. *S. b. medioximus*
9. *S. b. sphagnicola*

SYNAPTOMYS BOREALIS ARTEMISIAE Anderson.

1932. *Synaptomys borealis artemisiae* Anderson, Bull. [Ann. Rep. for 1931] Nat. Mus. Canada, 70:104, November 24, type from Stevenson Creek, SW Princeton, B. C. on Hope-Princeton Trail, east slope Cascade Range, 2400 ft., lat. 49° 23′ N, long. 120° 35′ W. Known only from vicinity of type locality and head of Whipsaw Creek, 5600 ft. (Anderson, 1947:145).

SYNAPTOMYS BOREALIS BOREALIS (Richardson).

1828. *Arvicola borealis* Richardson, Zool. Jour., 3:517, type from Fort Franklin, Great Bear Lake, Mackenzie District.

1902. *Synaptomys (Mictomys) bullatus* Preble, Proc. Biol. Soc. Washington, 15:181, August 6, type from Trout Rock, near Fort Rae, Great Slave Lake, Mackenzie District.

1907. *Synaptomys borealis,* Osgood, Proc. Biol. Soc. Washington, 20:49, April 18.

Marginal records.—Mackenzie District (A. B. Howell, 1927:24): Fort Franklin; Sarahk Lake. Alberta: Smith Landing (Fitzgerald) (*ibid.*). Saskatchewan: Brightsand Lake, about 65 mi. NNW north Battleford (Anderson, 1947:144). Alberta: "Edmonton district" (*ibid.*); Peace River Landing (A. B. Howell, 1927:24). British Columbia: near Tupper Creek School House (Cowan, 1939:82); *"Peace River block in northeastern British Columbia"* (Anderson, 1947:144). Mackenzie District: Fort Providence (A. B. Howell, 1927:24).

Synaptomys borealis chapmani J. A. Allen.

1903. *Synaptomys* (*Mictomys*) *chapmani* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 19:555, October 10, type from Glacier, Selkirk Range, British Columbia.
1927. *Synaptomys borealis chapmani,* A. B. Howell, N. Amer. Fauna, 50:9, August 5.

Marginal records.—Alberta: Ray Lake (Soper, 1948:60); Mt. Forget-me-not (A. B. Howell, 1927:26). Montana: Camas Creek, Glacier Nat'l Park (Wright, 1950:460). British Columbia: Green Mtn., 6300 ft. (Anderson, 1947:145); Canoe River (A. B. Howell, 1927:26).

Synaptomys borealis dalli Merriam.

1896. *Synaptomys* (*Mictomys*) *dalli* Merriam, Proc. Biol. Soc. Washington, 10:62, March 19, type from Nulato, Alaska.
1903. *Synaptomys* (*Mictomys*) *andersoni* J. A. Allen, Bull. Amer. Mus. Nat. Hist., 19:554; October 10, type from Level Mts., northern British Columbia.
1927. *Synaptomys borealis dalli,* A. B. Howell, N. Amer. Fauna, 50:9, August 5.

Marginal records (A. B. Howell, 1927:25, unless otherwise noted.)—Alaska: Bettles; mts. near Eagle. Yukon: Canol Road, Mile 249 (Anderson, 1947: 145). British Columbia: Great Glacier, Stikine River; Sixteen Mile Lake (Munro, 1947:141); Caribou Mtn., near Stuie (Anderson, 1947:145); Telegraph Creek; Atlin. Yukon: Burwash Landing (Anderson, 1947:145). Alaska: Prince William Sound; Seldovia; Lake Aleknagik; type locality.

Synaptomys borealis innuitus (True).

1894. *Mictomys innuitus* True, Diagnoses of new North American mammals, p. 3, April 24 (reprinted in Proc. U. S. Nat. Mus., 17:243, November 15), type from Fort Chimo, Quebec.
1927. *Synaptomys borealis innuitus,* A. B. Howell, N. Amer. Fauna, 50:9, August 5.

Marginal records.—Quebec: type locality; upper part Ste. Marguerite R., about 100 mi. N Gulf of St. Lawrence (Anderson, 1947:145); Godbout (Anderson, 1940:71); Rattogobas Lake, Swampy Bay River (Anderson and Rand, 1943A:102).

Synaptomys borealis medioximus Bangs.

1900. *Synaptomys* (*Mictomys*) *innuitus medioximus* Bangs, Proc. New England Zool. Club, 2:40, September 20, type from L'Anse au Loup, Strait of Belle Isle, Labrador.
1927. *Synaptomys borealis medioximus,* A. B. Howell, N. Amer. Fauna, 50:9, August 5.

Marginal records (Anderson, 1947:146).—Nain; Hamilton Inlet; type locality.

SYNAPTOMYS BOREALIS SMITHI Anderson and Rand.

1943. *Synaptomys borealis smithi* Anderson and Rand, Canadian Field-Nat., 57:101, December 10, type from Thicket Portage, Mile 165, H. B. Railroad, Manitoba.

Marginal records.—Manitoba: Ilford (Mile 286, Hudson Bay R. R.) Anderson, 1947:146). Ontario: Fort Severn (Anderson and Rand, 1943A: 102); Moosonee (*ibid.*) Manitoba: nr. Pine Falls, Winnepeg River (Soper, 1946:146); near the Dawson Cabin, N part Sandilands Forest Reserve (*ibid.*). Minnesota: Williams (Wetzel and Gunderson, 1949:437). Manitoba: Clear Lake, Riding Mtn. Park (Anderson and Rand, 1943A:102). Saskatchewan: Prince Albert Nat'l Park (Anderson, 1947:146).

SYNAPTOMYS BOREALIS SPHAGNICOLA Preble.

1899. *Synaptomys* (*Mictomys*) *sphagnicola* Preble, Proc. Biol. Soc. Washington, 13:43, May 29, type from Fabyans, Coos Co., New Hampshire.
1927. *Synaptomys borealis sphagnicola*, A. B. Howell, N. Amer. Fauna, 50:9, August 5.

Marginal records (Anderson, 1947:146).—Quebec: Tabletop Mtn. New Brunswick: Miramichi Road, 15 mi. from Bathurst. Maine: Mt. Katahdin. New Hampshire: type locality. Quebec: Ste. Rose.

SYNAPTOMYS BOREALIS WRANGELI Merriam.

1896. *Synaptomys* (*Mictomys*) *wrangeli* Merriam, Proc. Biol. Soc. Washington, 10:63, March 19, type from Wrangell, Alexander Archipelago, Alaska.
1927. *Synaptomys borealis wrangeli*, A. B. Howell, N. Amer. Fauna, 50.9, August 5.
1896. *Synaptomys* (*Mictomys*) *truei*, Merriam, Proc. Biol. Soc. Washington, 10:62, March 19, type from Skagit Valley, Skagit Co., Washington.

Marginal records (Howell, 1927:28, unless otherwise noted).—Alaska: Port Snettisham. British Columbia: Great Glacier (Swarth, 1922:172). Alaska: Anan Creek. Washington: Mt. Baker. British Columbia: Metlakatla. Alaska: type locality.

Genus DICROSTONYX Gloger—Collared Lemmings

Revised by G. M. Allen, Bull. Mus. Comp. Zool., 62:509-540, February, 1919. Canadian forms treated by Anderson and Rand, Jour. Mamm., 26:301-306, November 14, 1945.

1841. *Dicrostonyx* Gloger, Gemeinn, Hand- u. Hilfsbuch d. Naturgesch., 1:97. Type, an American species, probably *Mus hudsonius* Pallas.
1854. *Myolemmus* Pomel, Catal. Method., p. 27. Type, *Arvicola ambiguus* from the Pleistocene of France. According to Hinton (Monograph of the voles and lemmings . . . 1926:137), *Arvicola ambiguus* is an unidentifiable species.
1855. *Misothermus* Hensel, Zeitschr. der Deutsch geol. Gesellsch., 7:492. Type, *Mus torquatus* Pallas.
1881. *Borioikon* Poljakov, Mem. Acad. Imp. Sci. St. Petersbourg, 39: Supplement, p. 34. Type, *Mus torquatus* Pallas.
1897. *Tylonyx* Schulze, Mamm. Europaea in Helios, Abhandl. und Vorträge Gesammtgebiete Naturwiss., Berlin, 14:83. Type, *Mus torquatus* Pallas.

Total length, 132-160; tail, 10-22; hind foot, 15-24; ear, 6; weight, 45-75 grams; basal length of skull, 25.0-30.5; zygomatic breadth, 17.6-23.1. Ears entirely concealed in fur; foot-soles densely haired. In summer, upper parts brownish gray, buffy gray or variegated tawny and gray with black mid-dorsal stripe in some specimens; underparts (*D. g. rubricatus*) whitish but hairs plumbeous basally and lightly tipped with tawny. In winter all white (*D. g. unalascensis* and *D. g. stevensoni* excepted); white animals with foreclaws of digits 3 and 4 each with bulbous ventral part as large as dorsal part and separated from dorsal part by lateral groove and notch at end; ventral part absent in summer. Skull with squamosal pegs projecting anterolaterally behind orbits; tympanic bullae cancellous; lower incisor not extending behind m3; m1 with 7 closed triangles between terminal loops.

So far as known the collared, or varying, lemming occurs only in the treeless parts of the Arctic. It lives in short burrows; embryos number 3 to 11; some females produce 2 litters in a summer. This is the only rodent known to turn white in winter.

Key to Species of Dicrostonyx

1. First and second upper cheek-teeth without an accessory fold at the posterointernal corner; last lower molar normally lacking an accessory anterointernal fold and an anteroexternal enamel fold. . *D. hudsonius*, p. 480
1'. First and second upper cheek-teeth with small accessory enamel fold at posterointernal corner; last lower molar provided with accessory anterointernal enamel fold, and, in some forms, with anteroexternal accessory fold.
   2. Restricted to St. Lawrence Island. . . . . *D. exsul*, p. 484
   2'. Not on St. Lawrence Island; on Alaska Peninsula and North American mainland north of 58°. . . . . *D. groenlandicus*, p. 481

Dicrostonyx hudsonius (Pallas)

Labrador Collared Lemming

1778. *Mus hudsonius* Pallas, Novae species quad. glir. ord., p. 208, type from Labrador.
1897. *Dicrostonyx hudsonius*, Bangs, Proc. Biol. Soc. Washington, 11:237, September 17.

Marginal records.—Keewatin: Digges Islands (Anderson, 1947:148). Quebec: Rama (G. M. Allen, 1919:518); probably Straits of Belle Isle (*op. cit.*: 517; Lake Michikamau (*ibid.*), Great Whale River (*op. cit.*:518.). (Keewatin): Belcher Islands (Anderson, 1947:148).

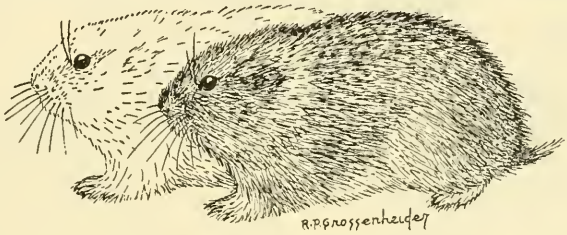
Six adults average: total length, 148: tail, 20.3; hind foot, 22.1. Maximum recorded is 160, 22, 24. In summer, adults nearly uniform buffy gray above, with indistinct blackish spinal stripe; ear tufts, flanks, and throat buffy or rusty; underparts gray, usually

strongly tinged with buffy; M1 and M2 each lacks posterointernal vestigial angle and with wall of hinder inner triangle reduced; m3 without anterior vestigial angles.

Dicrostonyx groenlandicus

Collared Lemming

Total length, 132-157; tail, 10-20; hind foot, 15-22. In summer, upper parts grizzled gray to grayish brown with more or less distinct dorsal blackish stripe; underparts grayish white, usually tinged with buff. All white in winter. M1 and M2 usually each with well-developed posterointernal vestigial angle and hind walls of posterointernal triangles retaining thick enamel and concave form; m3 usually with pair of anterior vestigial angles. In *D. g. richardsoni* three is the usual number of embryos and some females have two litters in the short summer season. In *D. g. alascensis* the number of embryos ranges from five to 11 (G. M. Allen, 1919:523, 529).



127 128

FIGS. 127 and 128. *Dicrostonyx groenlandicus rubricatus*, collared lemming. × ½. Fig. 127 shows the white winter pelage. Fig. 128 shows the summer pelage and is based on a specimen from Kaolak River, 70° 11′, 159° 47′, Alaska, July 14, 1951.

DICROSTONYX GROENLANDICUS GROENLANDICUS (Traill).

1823. *Mus groenlandicus* Traill, Scoresby's Jour. voy. northern whale-fishery, p. 416, type from Jamesons Land, Greenland.
1919. *Dicrostonyx groenlandicus*, G. M. Allen, Bull. Mus. Comp. Zool., 62:533, February.

Marginal records.—Greenland: "northeast Greenland, N to 83° 24′" (G. M. Allen, 1919:535); type locality. Franklin (Baffin Island): Cape Mercy (*ibid.*); Lake Harbour (Anderson and Rand, 1945:304); Cape Dorset (*ibid.*). Keewatin: Coral Harbour, Southampton Island (*ibid.*); Baker Lake (*ibid.*). Franklin: Iglulik Island, Fury and Hecla Strait (*ibid.*); Axel Heiberg Island (*op. cit.*: 303).

DICROSTONYX GROENLANDICUS KILANGMIUTAK Anderson and Rand.

1945. *Dicrostonyx groenlandicus kilangmiutak* Anderson and Rand, Jour. Mamm., 26:305, November 14, type from DeHaven Point, southeastern point of Victoria Island, west side Victoria Strait. Franklin District. Approximately 69° N lat., and 101° 30′ W long.

Marginal records (Anderson and Rand, 1945:306).—Franklin: Borden Island; Taylor Island. Keewatin: Queen Maud Sea area (*op. cit.*: p. 305). Mackenzie: Sifton Lake; Aklavik. Franklin: Cape Kellett, Banks Island.

Dicrostonyx groenlandicus richardsoni Merriam.

1900. *Dicrostonyx richardsoni* Merriam, Proc. Washington Acad. Sci., 2:26, March 14, type from Fort Churchill, Manitoba.
1935. *Dicrostonyx groenlandicus richardsoni*, Degerbøl, Rept. Fifth Thule Exped., Mammals, 2:9.

Marginal records (Anderson and Rand, 1945:304).—Mackenzie: Artillery Lake. Keewatin: Kazan River; Tavani. Manitoba: type locality.

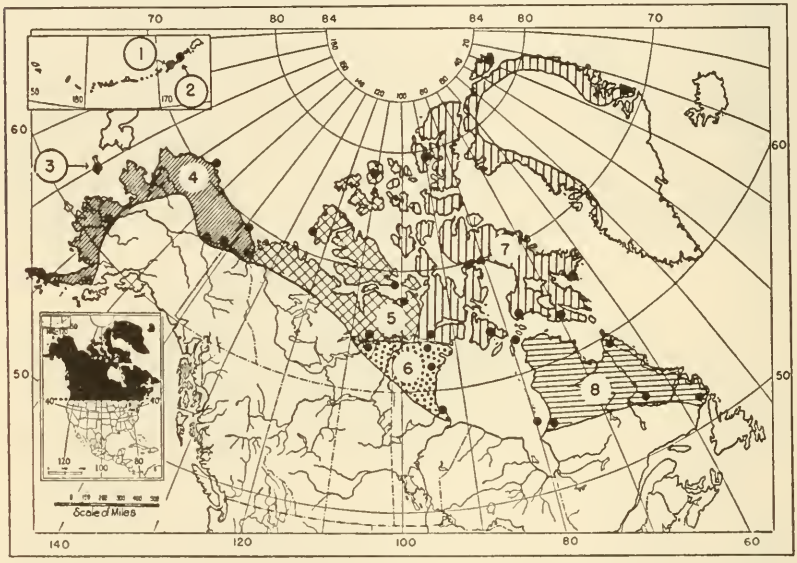
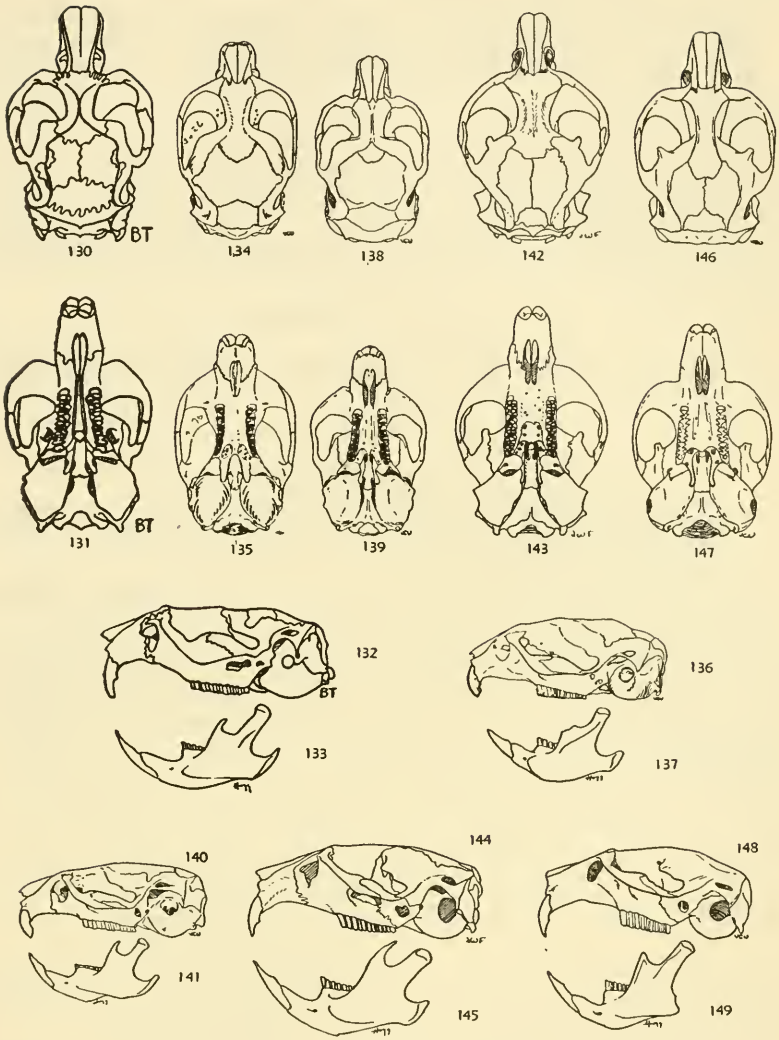


Fig. 129. Distribution of the species and subspecies of the Genus *Dicrostonyx*.

1. *D. groenlandicus stevensoni*
2. *D. groenlandicus unalascensis*
3. *D. exsul*
4. *D. groenlandicus rubricatus*
5. *D. groenlandicus kilangmiutak*
6. *D. groenlandicus richardsoni*
7. *D. groenlandicus groenlandicus*
8. *D. hudsonius*

Dicrostonyx groenlandicus rubricatus (Richardson).

1839. *Arvicola rubricatus* Richardson, Zool. Beechey's voyage, p. 7, type from American side of Bering Strait, Alaska.
1900. *Dicrostonyx nelsoni* Merriam, Proc. Washington Acad. Sci., 2:25, March 14, type from St. Michael, Norton Sound, Alaska.
1900. *Dicrostonyx hudsonius alascensis* Stone, Proc. Acad. Nat. Sci. Philadelphia, p. 37, March 24, type from Point Barrow, Alaska.
1937. *Dicrostonyx groenlandicus rubricatus*, Anderson, Mammals and birds of the western Arctic district, *in* Canada's Western Northland, Dept. of Mines and Resources, Ottawa, p. 110, July 9.
1948. *D[icrostonyx]. t[orquatus]. rubricatus*, Ognev, The mammals of Russia (U. S. S. R.) and adjacent countries, Publ. Acad. Sci. U. S. S. R., 6:479, 508. Ognev regards *D. groenlandicus* as conspecific with the earlier named *D. torquatus*.



FIGS. 130-149. Skulls of lemmings. All × 1.

FIGS. 130-133. *Lemmus trimucronatus alascensis*, Kaolak 69° 56′, 160° 15′, 152 ft., Alaska; ♂ 43297 KU.

FIGS. 134-137. *Synaptomys cooperi gossii*, 1 mi. W Lawrence, Kansas; ♂ 4626 KU.

FIGS. 138-141. *Synaptomys borealis dalli*, McIntyre Creek, 2250 ft., 3 mi. NW Whitehorse, Yukon; ♀ 21332 KU.

FIGS. 142-145. *Dicrostonyx hudsonius*, George River, Hudson Bay Post, 800 ft., Quebec; ♀ 29248 KU.

FIGS. 146-149. *Dicrostonyx groenlandicus richardsoni*, Fort Churchill, Manitoba; ♀ 1362 KU.

Marginal records.—Alaska: Point Barrow (Anderson and Rand, 1945:305). Yukon: Herschel Island (*ibid.*). Alaska (G. M. Allen, 1919:524): Porcupine River, 200 mi. above Yukon; Fort Yukon; Russian Mission; Moller Bay.

Dicrostonyx groenlandicus stevensoni Nelson.

1929. *Dicrostonyx unalascensis stevensoni* Nelson, Proc. Biol. Soc. Washington, 30:145, pl. 2, March 30, type from Umnak Island, Alaska. Known from type locality only.

1941. *Dicrostonyx rubricatus stevensoni*, Hayman and Holt, *in* Ellermann, Families and genera of living rodents, British Mus. (Nat. Hist.), 2:558, March 21.

Dicrostonyx groenlandicus unalascensis Merriam.

1900. *Dicrostonyx unalascensis* Merriam, Proc. Washington Acad. Sci., 2:25, March 14, type from Unalaska, Alaska. Known from type locality only.

Dicrostonyx exsul G. M. Allen

St. Lawrence Island Collared Lemming

1919. *Dicrostonyx exsul* G. M. Allen, Bull. Mus. Comp. Zool., 62:532, February, type from St. Lawrence Island, Bering Sea, Alaska. Known from type locality only.

Total length, 146; tail, 17; hind foot, 20. Upper parts in summer pinkish gray, blacker on rump; ear-patch mixture of ochraceous-buff and tawny; blackish median line indistinct; feet pale buff above in central part with whitish dusky tinge peripherally. In winter presumably all white. A subadult taken on June 24, contained four embryos.

LITERATURE CITED

Allen, G. M.
1919. The American collared lemmings (Dictostonyx). Bull. Mus. Comp. Zool., 62:509-540, 1 pl., 1 fig., February.

Allen, J. A.
1894. Notes on mammals from New Brunswick, with description of a new species of Evotomys. Bull. Amer. Mus. Nat. Hist., 6:99-106, April 14.
1903. Mammals collected in Alaska and northern British Columbia by the Andrew F. Stone Expedition of 1902. Bull. Amer. Mus. Nat. Hist., 19:521-567, October 10.

Anderson, R. M.
1937. Mammals and birds of the western Arctic District, Northwest Territories, Canada. Canada's Western Northland, pp. 97-122, unnumbered figs., 1 map, July 9.
1940. Mammifères de la Province de Québec. Ann. Rept. Prov. Soc. Nat. Hist., Canada for 1939, pp. 37-111, 1 fig., February 29.
1942. Canadian voles of the genus Phenacomys with description of two new Canadian subspecies. Canadian Field-Nat., 56:56-60, 1 pl., June 8.
1943. Nine additions to the list of Quebec mammals with descriptions of six new forms. Ann. Rept. Prov. Soc. Nat. Hist. for 1942: 49-62, September 7.
1947. Catalogue of Canadian Recent mammals. Bull. Nat. Mus. Canada, 102:v + 238, January 24.

Anderson, R. M., and Rand, A. L.
1943A. A new lemming mouse (*Synaptomys*) from Manitoba with notes on some other forms. Canadian Field-Nat., 101-103, December 10.
1943B. Status of the Richardson vole (*Microtus richardsoni*) in Canada. Canadian Field-Nat., 57:106-107, December 10.
1944. The long-tailed meadow mouse (*Microtus longicaudus*) in Canada. Canadian Field-Nat., 58:19-21, prior to May 22.
1945. The varying lemming (genus Dicrostonyx) in Canada. Jour. Mamm., 26:301-306, November 14.

Bailey, A. M., and Hendee, R. W.
1926. Notes on the mammals of northwestern Alaska. Jour. Mamm., 7:9-28, 3 pls., February 15.

Bailey, V.
1897. Revision of the American voles of the genus Evotomys. Proc. Biol. Soc. Washington, 11:113-138, May 13.
1900. Revision of American voles of the genus Microtus. N. Amer. Fauna, 17:1-88, 5 pls., 17 figs., June 6.
1905. Biological survey of Texas. N. Amer. Fauna, 25:1-222, 16 pls., 24 figs. in text, October 24.
1917. A new subspecies of meadow mouse from Wyoming. Proc. Biol. Soc. Washington, 30:29-30, February 21.

1918. Wild animals of Glacier National Park. The mammals. Dept. Interior, National Park Service, pp. 25-102, illustrated.
1927. A biological survey of North Dakota. N. Amer. Fauna, 49:vi + 226, 21 pls., 8 figs. in text, January 8.
1932. Mammals of New Mexico. N. Amer. Fauna, 53:1-412, 22 pls., 58 figs. in text, March 1.
1936. The mammals and life zones of Oregon. N. Amer. Fauna, 55:1-416, 1 map, 5 pls., 102 figs. in text, August 29.

Baker, R. H.
1951. Mammals taken along the Alaska Highway. Univ. Kansas Publ., Mus. Nat. Hist., 5(9):87-117, 1 fig. in text, November 28.

Banfield, A. W. F.
1951. Notes on the mammals of the Mackenzie District, Northwest Territories. Arctic, 4:113-121, illus., September.

Bangs, O.
1894. Synaptomys cooperi Baird in eastern Massachusetts; with notes on Synaptomys stonei Rhoads, especially as to the validity of this species. Proc. Biol. Soc. Washington, 9:99-104, April 14.
1898. A new rock vole from Labrador. Proc. Biol. Soc. Washington, 12:187-188, November 16.

Barbour, R. W., and Barbour, B. L.
1950. Some mammals from Hart County, Kentucky. Jour. Mamm., 31:359-360, August 21.

Benson, S. B., and Borell, A. E.
1931. Notes on the life history of the red tree mouse, Phenacomys longicaudus. Jour. Mamm., 12:226-233, 1 fig., August 24.

Black, J. D.
1936. Mammals of northwestern Arkansas. Jour. Mamm., 17:29-35, February 17.

Blair, W. F.
1939. Faunal relationships and geographic distribution of mammals in Oklahoma. Amer. Midland Nat., 22:85-133, 1 fig., July.

Bole, B. F., Jr.
1938. The pine mouse of southern Ohio. Jour. Mamm., 19:377, August 18.

Bole, B. F., Jr., and Moulthrop, P. N.
1942. The Ohio Recent mammal collection in the Cleveland Museum of Natural History. Scientific Publs., Cleveland Mus. Nat. Hist., 5:83-181, September 11.

Booth, E. S.
1945. A new red-backed mouse from Washington state. Murrelet, 26:27-28, August 10.

Breckenridge, W. J.
1936. Mammals collected in northern Manitoba. Jour. Mamm., 17:61-62, February 17.

Bryant, M. D.
1941. A far southwestern occurrence of Pitymys in Texas. Jour. Mamm., 22:202, May 13.

Burroughs, A. L., Holdenried, R., Longanecker, D. S., and Meyer, K. F.
1945. A field study of latent tularemia in rodents, with a list of all known naturally infected vertebrates. Jour. Infect. Diseases, 76:115-119.

Burt, W. H.
1946. The mammals of Michigan. Univ. Michigan Press, Ann Arbor, xv + 288 pp., illustrated.

Cahn, A. R.
1937. The mammals of Quetico Provincial Park of Ontario. Jour. Mamm., 18:19-30, February 11.

Cameron, A. W., and Morris, W. A.
1951. The mammals of the Lake Mistassini and Lake Albanel regions, Quebec. Nat. Mus. Canada Bull., 123:120-130, prior to October 30.

Cary, M.
1911. A biological survey of Colorado. N. Amer. Fauna, 33:1-256, 12 pls., 39 figs. in text, August 17.

Cockrum, E. L.
1952. Mammals of Kansas. Univ. Kansas Publ., Mus. Nat. Hist., 7: 1-303, 73 figs. in text, 37 tables, August 25.

Cockrum, E. L., and Fitch, K. M.
1952. Geographic variation in red-backed mice (Genus Clethrionomys) of the southern Rocky Mountain region. Univ. Kansas Publ., Mus. Nat. Hist., 5:281-292, November 15, 1952.

Cooley, R. A.
1938. The genera *Dermacentor* and *Otocentor* (Ixodidae) in the United States, with studies in variation. National Inst. Health Bull., 171: v + 89, 30 pls., 8 figs.

Copeland, M.
1912. Notes on the mammals of Mt. Greylock, Massachusetts. Proc. Biol. Soc. Washington, 25:157-162, December 4.

Cory, C. D.
1912. The mammals of Illinois and Wisconsin. Field Mus. Nat. Hist., Publ. 153, zool. ser., 11:1-505, many unnumbered pls., figs., and maps in text.

Cowan, I. McT.
1939. The vertebrate fauna of the Peace River District of British Columbia. Occas. Papers British Columbia Prov. Mus., 1:8 + 102, 5 pls., June 1.
1951. A new *Microtus* from the western Arctic of Canada. Jour. Mamm., 32:353-354, August 23.

Crowe, P. E.
1943. Notes on some mammals of the southern Canadian Rocky Mountains. Bull. Amer. Mus. Nat. Hist., 80:391-410, 4 pls., 1 fig. in text, February 4.

Dale, F. H.
1940. Geographic variation in the meadow mouse in British Columbia and southeastern Alaska. Jour. Mamm., 21:332-340, 1 table, August 13.

Dalquest, W. W.
1940. New meadow mouse from the San Juan Islands, Washington. Murrelet, 21:7-8, April 30.
1948. Mammals of Washington. Univ. Kansas Publ., Mus. Nat. Hist., 2:1-444, 140 figs. in text, April 9.
1950. Records of mammals from the Mexican state of San Luis Potosí. Occas. Papers Mus. Zool., Louisiana State Univ., 23:1-15, July 10.

Davis, D. E.
1936. Status of Microtus enixus and Microtus terraenovae. Jour. Mamm., 17:290-291, August 17.

Davis, W. B.
1939. The Recent mammals of Idaho. The Caxton Printers, Caldwell, Idaho, 400 pp., 2 full pages half tones, 33 figs. in text, April 5.
1944. Geographic variation in brown lemmings (genus *Lemmus*). Murrelet, 25:19-25, September 19.

Davis, W. B., and Lowery, G. H., Jr.
1940. The systematic status of the Louisiana muskrat. Jour. Mamm., 21: 212-213, May 16.

Davis, W. B., and Robertson, J. L., Jr.
1944. The mammals of Culberson County, Texas. Jour. Mamm., 25:254-273, 1 pl., 2 figs. in text, September 8.

Dellinger, S. C., and Black, J. D.
1940. Notes on Arkansas mammals. Jour. Mamm., 21:187-191, May 16.

Dice, L. R.
1919. The mammals of southeastern Washington. Jour. Mamm., 1:10-21, 2 pls., November 28.
1921. Notes on the mammals of interior Alaska. Jour. Mamm., 2:20-28, February 10.
1923. Mammal associations and habitats of the Flathead Lake region, Montana. Ecology, 4:247-260, 3 figs., July.

Dixon, J. S.
1938. Birds & mammals of Mount McKinley National Park, Alaska. Fauna Series (National Park Service), 3:xii + 236, frontispiece and 85 figs.

Doutt, J. K.
1941. New *Clethrionomys* from Utah and Pennsylvania. Proc. Biol. Soc. Washington, 54:161-162, December 8.

Durrant, S. D.
1952. Mammals of Utah, *taxonomy and distribution.* Univ. Kansas Publ., Mus. Nat. Hist., 6:1-549, 91 figs. in text, 30 tables, August 10.

Dymond, J. R.
1928. The mammals of the Lake Nipigon region, pp. 239-250. *In* A faunal survey of the Lake Nipigon region, Ontario by Dymond, J. R., Sny-

der, L. L., and Logier, E. B. S. Trans. Royal Canadian Inst., 16(2): 233-291, 1 pl., 1 map.

Eadie, W. R.
1937. The Cooper lemming mouse in southern New Hampshire. Jour. Mamm., 18:102-103, February 11.
1939. A contribution to the biology of Parascalops breweri. Jour. Mamm., 20:150-173, 2 pls., 2 figs. in text, May 15.

Ellerman, J. R.
1941. The families and genera of living rodents. British Mus. (Nat. Hist.), Vol. 2, pp. xii + 690, 50 figs., March 21.

Ellerman, J. R., and Morrison-Scott, T. C. S.
1951. Checklist of Palaearctic and Indian Mammals. British Mus. (Nat. Hist.), pp. 1-810, 1 map, November 19.

Elliot, D. G.
1907. A catalogue of the collection of mammals in the Field Columbian Museum. Field Columbian Mus. Publ. 115, zool. ser., 8:viii + 694, 92 figs. in text, February 9.

Enders, R. K.
1928. Two new records from Ohio. Jour. Mamm., 9:155, May 9.
1932. Mammal distribution in Saline and Camden counties, Missouri. Amer. Midland Nat., 13:114-123, May.

Fichter, E., and Hansen, M. F.
1947. The Goss lemming mouse, *Synaptomys cooperi gossii* (Coues), in Nebraska. Bull. Univ. Nebraska State Mus., 3(2):1-8, 2 figs., 1 table, September.

Fisher, H. J.
1946. Notes on voles in central Missouri. Jour. Mamm., 26:435-437, February 12.

Goldman, E. A.
1932. A new muskrat from Arizona. Proc. Biol. Soc. Washington, 45:93-94, June 21.
1938. Notes on the voles of the Microtus longicaudus group. Jour. Mamm., 19:491-492, November 14.
1938. Three new races of Microtus mexicanus. Jour. Mamm., 19:493-495, November 14.
1941. Remarks on voles of the genus *Lemmiscus*, with one described as new. Proc. Biol. Soc. Washington, 54:69-71, July 31.

Goodwin, G. G.
1924. Mammals of the Gaspé Peninsula, Quebec. Jour. Mamm., 5:246-257, November 15.
1929. Mammals of the Cascapedia Valley, Quebec. Jour. Mamm., 10:239-246, August 10.
1935. The mammals of Connecticut. Bull. Connecticut State Geol. and Nat. Hist. Surv., 53:1-221, 33 pls., 19 figs. in text.

Green, M. M.
1930. A contribution to the mammalogy of the North Mountain Region of Pennsylvania. Privately published, Ardmore, Pennsylvania, pp. 1-19, 1 colored plate, March 31.

Grinnell, J.
1926. Critical examination of the meadow mice of Lower California. Jour. Mamm., 7:221-226, August 9.
1933. Review of the Recent mammal fauna of California. Univ. California Publ. Zool., 40:71-234, September 26.

Grinnell, J., Dixon, J., and Linsdale, J. M.
1930. Vertebrate natural history of a section of northern California through the Lassen Peak Region. Univ. California Publ. Zool., 35:v + 594, 181 figs. in text, October 10.

Hall, E. R.
1929. Mammals collected by Charles D. Brower at Point Barrow, Alaska. Univ. California Publ. Zool., 30:419-425, March 19.
1931. Critical comments on mammals from Utah, with descriptions of new forms from Utah, Nevada and Washington. Univ. California Publ. Zool., 37:1-13, April 10.
1934. Mammals collected by T. T. and E. B. McCabe in the Bowron Lake Region of British Columbia. Univ. California Publ. Zool., 40:363-368, 1 fig., November 5.
1938. Mammals from Touchwood Hills, Saskatchewan. Canadian Field-Nat., 52:108-109, October.
1938. Notes on the meadow mice Microtus montanus and M. nanus with description of a new subspecies from Colorado. Proc. Biol. Soc. Washington, 51:131-134, August 23.
1946. Mammals of Nevada. Univ. California Press, Berkeley, xi + 710, colored frontispiece, 11 pls., 485 figs. in text, plus 54 silhouettes, July 1.
1951A. A synopsis of the North American Lagomorpha. Univ. Kansas Publs., Mus. Nat. Hist., 5:119-202, 68 figs. in text, December 15.
1951B. American weasels. Univ. Kansas Publ., Mus. Nat. Hist., 4:1-466, 41 pls., 31 figs. in text, December 27.

Hall, E. R., and Cockrum, E. L.
1952. Comments on the taxonomy and geographic distribution of North American microtines. Univ. Kansas Publ., Mus. Nat. Hist., 5:293-312, November 17.

Hall, E. R., and Gilmore, R. M.
1932. New mammals from St. Lawrence Island, Bering Sea, Alaska. Univ. California Publ. Zool., 38:391-404, 2 pls., 1 fig. in text, September 17.

Hall, E. R., and Kelson, K. R.
1951. A new subspecies of Microtus montanus from Montana and comments on Microtus canicaudus Miller. Univ. Kansas Publs., Mus. Nat. Hist., 5:73-79, October 1.

Hall, E. R., and Villa, R. B.
1949. An annotated check list of the mammals of Michoacán, México. Univ. Kansas Publs., Mus. Nat. Hist., 1:433-472, 2 pls., 1 fig. in text, December 27.

Hamilton, W. J., Jr.
1939. American Mammals. McGraw-Hill Book Co., Inc., New York, pp. xii + 434, frontispiece, 92 figs. in text.

Handley, C. O., Jr.
1952. A new pine mouse (*Pitymys pinetorum carbonarius*) from the southern Appalachian Mountains. Jour. Washington Acad. Sci., 42:152-153, May.

Handley, C. O., Jr., and Patton, C. P.
1947. Wild mammals of Virginia. Commonwealth of Virginia Comm. Game and Inland Fisheries, Richmond, vi + 220 pp., frontispiece, 103 figs. in text.

Hanson, H. C.
1944. Small mammal censuses near Prairie du Sac, Wisconsin. Trans. Wisconsin Acad. Sci., Arts and Letters, 36:105-129, 21 tables (only the reprint was seen by us; it was issued January 12, 1946).

Harper, F.
1927. The mammals of the Okefinokee Swamp Region of Georgia. Proc. Boston Soc. Nat. Hist., 38:191-396, 4 pls., 5 figs., March.
1932. Mammals of the Athabaska and Great Slave lakes region. Jour. Mamm., 13:19-36, February 9.

Hatfield, D. M.
1935. Description of a new race of Microtus californicus. Jour. Mamm., 16:316-318, November 15.

Hatfield, D. M., and Hooper, E. T.
1935. Notes on the voles of the species *Microtus oregoni*. Murrelet, 16: 33-34, 1 fig., May.

Heller, E.
1909. Birds and mammals of the 1907 Alexander expedition to southeastern Alaska. Univ. California Publ. Zool., 5:171-264, 2 pls., 4 figs., February.
1910. Mammals of the 1908 Alexander Alaska expedition and descriptions of the localities visited and notes on the flora of the Prince William Sound Region. Univ. California Publ. Zool., 5:321-360, 2 pls., March 5.

Hill, J. E.
1942. Notes on mammals of northeastern New Mexico. Jour. Mamm., 23:75-82, 1 fig. in text, February 16.

Hollister, N.
1911. A systematic synopsis of the muskrats. N. Amer. Fauna, 32:1-47, 6 pls., April 29.

Hooper, E. T.
1944. San Francisco Bay as a factor influencing speciation in rodents. Univ. Michigan, Mus. Zool., Misc. Publ., 59:1-89, 5 pls., 18 maps, January 12.

Howell, A. B.
1920. Microtus townsendi in the Cascade Mountains of Oregon. Jour. Mamm., 1:141-142, June 19.
1923. Description of a new microtine rodent from Oregon, with some remarks on some contiguous forms. Jour. Mamm., 4:33-37, February 9.
1926. Voles of the genus Phenacomys. N. Amer. Fauna, 48:iv + 66, 7 pls., 10 figs., October 16.
1927. Revision of the American lemming mice. N. Amer. Fauna, 50:ii + 38, 2 pls., 11 figs., August 5.

Howell, A. H.
1910. Notes on mammals of the middle Mississippi Valley, with description of a new woodrat. Proc. Biol. Soc. Washington, 23:23-34, March 23.
1921. A biological survey of Alabama. N. Amer. Fauna, 45:1-88, 10 figs. in text, October 28.
1934. The type locality of Pitymys parvulus. Jour. Mamm., 15:72. February 15.

Huey, L. M.
1931. A new meadow mouse from Lower California, Mexico. Trans. San Diego Soc. Nat. Hist., 7:47-49, December 19.

Humpreys, F. A., and Campbell, A. G.
1947. Plague, Rocky Mountain Spotted Fever, and tularemia surveys in Canada. Canadian Jour. Public Health, 38:124-130.

Jackson, C. F.
1938. Notes on the mammals of southern Labrador. Jour. Mamm., 19:429-434, November 14.

Jackson, H. H. T.
1941. A new pine mouse, genus Pitymys, from Wisconsin. Proc. Biol. Soc. Washington, 54:201-202, December 8.

James, W. B., and Booth, E. S.
1952. Biology and life history of the sagebrush vole. Walla Walla College Publ., Dept. Biol. Sci., 1:23-43, 11 figs., July 20.

Jameson, E. W., Jr.
1943. Notes on the habits and Siphonapterous parasites of the mammals of Welland County, Ontario. Jour. Mamm., 24:194-197, June 7.

Jellison, W. L., Eneboe, P. L., Parker, R. R., and Hughes, L. E.
1949. Rat-bite fever in Montana. Public Health Reports, 64:1661-1665, December 30.

Jewett, S. G.
1920. Notes on two species of Phenacomys in Oregon. Jour. Mamm., 1:165-168, August 24.

Johnson, M. L., Clanton, C. W., and Girard, J.
1949. The sagebrush vole in Washington state. Murrelet, 29:44-47, March 1.

Johnson, M. S.
1935. Pine mouse in Essex County, Massachusetts. Jour. Mamm., 16:68-69, February 14.

Jones, J. K., Jr., and Webb, O. L.
1949. Notes on mammals from Richardson County, Nebraska. Jour. Mamm., 30:312-313, August 17.

Kellogg, R.
1918. A revision of the Microtus californicus group of meadow mice. Univ. California Publ. Zool., 21:1-42, December 28.
1922. A study of the Californian forms of the Microtus montanus group of meadow mice. Univ. California Publ. Zool., 21:245-274, 25 figs. in text, April 18.
1922. A synopsis of the Microtus mordax group of meadow mice in California. Univ. California Publ. Zool., 21:275-302, 1 pl., 29 figs. in text. April 18.
1937. Annotated list of West Virginia mammals. Proc. U. S. Nat. Mus., 84:443-479, prior to November 17.
1939. Annotated list of Tennessee mammals. Proc. U. S. Nat. Mus., 86:245-303, prior to March 27.

Kelson, K. R.
1951. Speciation in rodents of the Colorado River drainage of eastern Utah. Univ. Utah Biol. Series, 11(3):vii + 125, 10 figs., February 15.

Komarek, E. V.
1932. Distribution of Microtus chrotorrhinus, with description of a new subspecies. Jour. Mamm., 13:155-158, 1 map, 1 fig., May 11.
1932. Notes on mammals of Menomenee Indian Reservation, Wisconsin. Jour. Mamm., 13:203-209, August 9.

Laing, H. M., Taverner, P. A., and Anderson, R. M.
1929. Birds and mammals of the Mount Logan expedition, 1925. Bull. Nat. Mus. Canada, 56:69-107, prior to November 25.

Lahnum, W. H.
1946. Mammals and plague distribution in the United States. Bull. U. S. Naval Med., 46:782-785, tables.

Leraas, H. J.
1942. Notes on mammals from west-central Minnesota. Jour. Mamm., 23:343-345, August 13.

Lowery, G. H., Jr.
1936. A preliminary report on the distribution of the mammals of Louisiana. Proc. Louisiana Acad. Sci., 3(1):11-39, 4 pls., 2 figs. (maps), March.
1943. Check-list of the mammals of Louisiana and adjacent waters. Occas. Papers Mus. Zool., Louisiana State Univ., 13:213-257, 5 figs. in text, November 22.

Macnab, J. A., and Dirks, J. C.
1941. The California red-backed mouse in the Oregon Coast Range. Jour. Mamm., 22:174-180, 1 table, May 13.

Mailliard, J.
1925. Notes upon the numerical status of rodent populations in parts of California. Jour. Mamm., 6:102-105, May 12.

Manville, R. H.
1942. Notes on the mammals of Mount Desert Island, Maine. Jour. Mamm., 23:391-398, December 30.

Merriam, C. H.
1899. Results of a biological survey of Mount Shasta, northern California. N. Amer. Fauna, 16:1-179, 5 pls., 46 figs., October 28.

Miller, G. S., Jr.
1897. Notes on the mammals of Ontario. Proc. Boston Soc. Nat. Hist., 28:1-44, April 30.
1899. Preliminary list of New York Mammals. Bull. New York State Mus., 6:273-390, November 18.

Munro, J. A.
1947. Observations of birds and mammals in central British Columbia. Occas. Pap. British Columbia Prov. Mus., 6:1-165, 52 figs., January.
1950. Birds and mammals of the Creston region, British Columbia. Occas. Pap. British Columbia Prov. Mus., 8:1-90, 16 figs., August.

Necker, W. L., and Hatfield, D. M.
1941. Mammals of Illinois. Bull. Chicago Acad. Sci., 6:17-60, 15 figs. in text, May 15.

Nelson, A. L.
1934. Two mammal records for South Carolina. Jour. Mamm., 15:253-254, August 10.

Nelson, E. W.
1931. A new vole of the subgenus Stenocranius from Alaska. Jour. Mamm., 12:310-312, August 24.

Newsom, W. M.
1937. Mammals on Anticosti Island. Jour. Mamm., 18:435-442, November 22.

Odum, E. P.
1948A. Synaptomys on the Highlands, North Carolina, Plateau. Jour. Mamm., 29:74, February 13.
1948B. *Microtus* from the Piedmont of Georgia. Jour. Mamm., 29:74, February 13.
1949. Small mammals of the Highlands (North Carolina) Plateau. Jour. Mamm., 30:179-192, 1 pl., 1 fig., 1 table, May 23.

Orr, R. T.
1932. Occurrence of the short-tailed meadow mouse in northern California. Jour. Mamm., 13:167, May 11.
1945. A study of the *Clethrionomys dawsoni* group of red-backed mice. Jour. Mamm., 26:67-74, February 27.

Osgood, F. L., Jr.
1938. The mammals of Vermont. Jour. Mamm., 19:435-441, November 14.

Osgood, W. H.
1900. Results of a biological reconnaissance of the Yukon River region. N. Amer. Fauna, 19:1-100, 7 pls., October 6.
1904. A biological reconnaissance of the base of the Alaska Peninsula. N. Amer. Fauna, 24:1-86, 7 pls., November 23.
1909. Biological investigations in Alaska and Yukon Territory. N. Amer. Fauna, 30:1-96, 5 pls., 2 figs. in text, October 7.

Owen, R. D., and Shackelford, R. M.
1942. Color aberrations in Microtus and Pitymys. Jour. Mamm., 23:306-316, 1 pl., August 13.

Parker, H. C.
1939. A preliminary list of the mammals of Worcester County, Massachusetts. Proc. Boston Soc. Nat. Hist., 41:403-415, January.

Patton, C. P.
1939. Distribution notes on certain Virginia mammals. Jour. Mamm., 20: 75-77, February 15.

Penney, J. T.
1950. Distribution and bibliography of the mammals of South Carolina. Jour. Mamm., 31:81-89, February 21.

Poole, E. L.
1943. Synaptomys cooperi stonei from the eastern shore of Maryland. Jour. Mamm., 24:103, February 20.

Preble, E. A.
1902. A biological investigation of the Hudson Bay region. N. Amer. Fauna, 22:1-140, 14 pls., October 31.
1908. A biological investigation of the Athabaska-Mackenzie region. N. Amer. Fauna, 27:1-574, 25 pls., 13 figs. in text, October 26.

Quay, W. B.
1949. Notes on mammals of Thomas County, Georgia, with two state records. Jour. Mamm., 30:66-68, February 14.
1951. Observations on mammals of the Seward Peninsula, Alaska. Jour. Mamm., 32:88-99, 3 figs., February 15.

Racey, K., and Cowan, I. McT.
1935. Mammals of the Alta Lake region of south-western British Columbia. Rept. Prov. Mus. British Columbia, 1935: H15-H29, 5 pls., 1 fig., 2 tables.

Rand, A. L.
1943. Canadian forms of the meadow mouse (*Microtus pennsylvanicus*). Canadian Field-Nat., 57:115-123, December 10.
1945. Mammal investigations on the Canol Road, Yukon and Northwest Territories, 1944. Bull. Nat. Mus. Canada, 99:4 + 52, 20 pls., prior to June 20.
1945A. Mammals of Yukon. Bull. Nat. Mus. Canada, 100:4 + 93, 28 figs., prior to June 20.

Rausch, R.
1950. Notes on microtine rodents from the Brooks Range, Arctic Alaska. Jour. Washington Acad. Sci., 40:133-136, April 21.
1951. Notes on the Nunamiut Eskimo and mammals of the Anaktuvuk Pass region, Brooks Range, Alaska. Arctic, 4:146-195, 15 figs., December.

Sanborn, C. C.
1930. Notes from northern and central Illinois. Jour. Mamm., 11:222-223, May 9.

Saunders, W. E.
1932. Notes on the mammals of Ontario. Trans. Royal Canadian Inst., 18(2):271-309.

Schantz, V. S., and Jenkins, J. H.
1950. Extension of range of the round-tailed muskrat, *Neofiber alleni*. Jour. Mamm., 31:460-461, November 21.

Schmidt, F. J. W.
1931. Mammals of western Clark County, Wisconsin. Jour. Mamm., 12:99-117, 1 map, May 14.

Schwartz, A.
1952. A new race of the round-tailed muskrat, *Neofiber alleni*, from southern Florida. Chicago Acad. Sci., Nat. Hist. Misc., 101:1-3, February 15.

Schwartz, H.
1929. Tularemia from the muskrat. Amer. Medical Assoc. Jour., 92:1180-1181.

Scott, T. G.
1937. Mammals of Iowa. Iowa State Coll. Jour. Sci., 12:43-97, 1 fig., October.

Setzer, H. W.
1952. A new subspecies of Microtus oeconomus from Alaska. Proc. Biol. Soc. Washington, 65:75-76, April 25.

Sheldon, W. G.
1932. Mammals collected or observed in the vicinity of Laurier Pass, B. C. Jour. Mamm., 13:196-203, August 9.

Sherman, H. B.
1929. Notes on some Florida mammals. Jour. Mamm., 10:258-259, August 10.
1937. A list of the Recent land mammals of Florida. Proc. Florida Acad. Sci. for 1936:102-128.
1945. Recent literature and some new distribution records concerning Florida mammals. Proc. Florida Acad. Sci., 7(2-3):199-202, prior to March 12.

Simpson, G. G.
1945. The principles of classification and a classification of mammals. Bull. Amer. Mus. Nat. Hist., 85:xvi + 350, October 5.

Smith, R. W.
1940. The land mammals of Nova Scotia. Amer. Midland Nat., 24:213-241, July 31.

Snyder, L. L.
1928. The mammals of the Lake Abitibi region. Univ. Toronto Studies, Biol. Series, 32:7-15.

Soper, J. D.
1942. Mammals of Wood Buffalo Park, northern Alberta and District of Mackenzie. Jour. Mamm., 23:119-145, 2 pls., 1 fig. in text, June 3.
1944. The mammals of southern Baffin Island, Northwest Territories, Canada. Jour. Mamm., 25:221-254, 2 pls., 2 figs., 2 unnumbered maps, September 8.
1946. Mammals of the northern Great Plains along the International Boundary in Canada. Jour. Mamm., 27:127-153, 1 fig. in text, May 14.
1948. Mammal notes from the Grande Prairie-Peace River region, Alberta. Jour. Mamm., 29:49-64, 1 pl., 1 fig. in text, February 13.

Stone, W.
1908. The mammals of New Jersey. Rept. New Jersey State Mus. for 1907: 33-110, 203-205, 58 pls.

Stoner, D.
1918. The rodents of Iowa. Iowa Geol. Surv. Bull., 5:1-172, 37 figs.

Storer, T. I.
1937. The muskrat as native and alien. Jour. Mamm., 18:443-460, 6 figs., November 22.

Svihla, R. D.
1931. Mammals of the Uinta Mountain region. Jour. Mamm., 12:256-266, 1 pl., 1 fig. in text, August 24.

Swanson, G.
1945. A systematic catalog of the mammals of Minnesota, pp. 52-108. *In* The mammals of Minnesota, by Swanson, G., Surber, T., and Roberts, T. S. Minnesota Dept. Conservation, Tech. Publ., 2:1-108, numerous unnumbered pls. and figs., prior to June 13.

Swarth, H. S.
1911. Birds and mammals of the 1909 Alexander Alaska expedition. Univ. California Publ. Zool., 7:9-172, 6 pls., 3 figs. in text, January 12.
1922. Birds and mammals of the Stikine River region of northern British Columbia and southeastern Alaska. Univ. California Publ. Zool., 24:125-314, 8 pls., 34 figs. in text, June 17.
1933. The long-tailed meadow-mouse of southeastern Alaska. Proc. Biol. Soc. Washington, 46:207-211, October 26.
1936. Mammals of the Atlin region, northwestern British Columbia. Jour. Mamm., 17:398-405, November 16.

Schwartz, A.
1952. A new race of the round-tailed muskrat, *Neofiber alleni*, from southern Florida. Nat. Hist. Miscellanae (Chicago Acad. Sci.), 101:1-3, February 15, 1952.

Taylor, W. P.
1920. A new meadow mouse from the Cascade Mountains of Washington. Jour. Mamm., 1:180-182, August 24.

Taylor, W. P., and Davis, W. B.
1947. The mammals of Texas. Texas Game, Fish and Oyster Comm. Bull., 27:1-79, illustrated, August.

Taylor, W. P., and Shaw, W. T.
1929. Provisional list of land mammals of the state of Washington. Occas. Papers Charles R. Conner Mus., Washington State College, 2:1-32, December.

vonBloeker, J. C., Jr.
1937. Four new rodents from Monterey County, California. Proc. Biol. Soc. Washington, 50:153-157.

Walker, A.
1930. Notes on the forest Phenacomys. Jour. Mamm., 11:233-235, May 9.

Warren, E. R.
1942. The mammals of Colorado. Univ. Oklahoma Press, xviii + 330 pp., 50 pls.

Weaver, R. L.
1940. Notes on a collection of mammals from the southern coast of the Labrador Peninsula. Jour. Mamm., 21:417-422, November 14.

Welter, W. A., and Sollberger, D. E.
1939. Notes on the mammals of Rowan and adjacent counties in eastern Kentucky. Jour. Mamm., 20:77-81, February 15.

Wetzel, R. M., and Gunderson, H. L.
1949. The lemming vole, *Synaptomys borealis,* in northern Minnesota. Jour. Mamm., 30:437, November 17.

Whitlow, W. B., and Hall, E. R.
1933. Mammals of the Pocatello region of southeastern Idaho. Univ. California Publ. Zool., 40:235-276, 3 figs. in text, September 30.

Wight, H. M.
1925. Notes on the tree mouse, Phenacomys silvicola. Jour. Mamm., 6:282-283, November 14.

Wilber, C. G.
1946. Mammals of the Knik River Valley, Alaska. Jour. Mamm., 27:213-216, 1 pl., August 14.

Wilson, L. W.
1943. Some mammalian ectoparasites from West Virginia. Jour. Mamm., 24:102, February 20.

Wright, P. L.
1950. *Synaptomys borealis* from Glacier National Park, Montana. Jour. Mamm., 31:460, November 21.

Wyman, L. C.
1922. The validity of the Penobscot field mouse. Jour. Mamm., 3:162-166, August 4.
1923. Microtus chrotorrhinus in Maine. Jour. Mamm., 4:125-126, May 9.

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The Pocket Gophers (Genus Thomomys) of Coahuila, Mexico

BY

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The Pocket Gophers (Genus Thomomys) of Coahuila, México

BY

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Only two kinds of pocket gophers of the genus *Thomomys* heretofore have been reported from Coahuila: *T. sturgisi* Goldman, from the type locality in northern Coahuila, and *T. umbrinus analogus* Goldman, from several localities in the southeastern part of that state. Beginning in 1949 several workers from the University of Kansas Museum of Natural History obtained additional specimens which show that this genus occurs in most parts of Coahuila. *Thomomys* is more abundant at high elevations than at low elevations. In the lower areas *Cratogeomys* tends to replace *Thomomys* although at some localities both genera are found together (for example, in Cañon del Cochino, 3200 ft., 16 mi. N and 21 mi. E Piedra Blanca; at 3 mi. SE Sierra Mojada, 4100 ft.; Jaral; Carneros; 4 mi. S and 6 mi. E Saltillo, 7500 ft.). Investigations made to date have been insufficient to determine whether mountain- and plains-dwelling *Thomomys* are part of a continuous population or whether some of the mountain-dwelling pocket gophers are isolated.

Initially an attempt was made to refer this new material to one or more of the named kinds, which occur in Coahuila or in adjacent Mexican states and Trans-Pecos Texas. These species are *T. sturgisi, T. umbrinus, T. baileyi* and *T. bottae.* The following currently recognized kinds of pocket gophers (topotypes and other specimens) have been examined: *Thomomys baileyi nelsoni* Merriam, *T. b. spatiosus* Goldman, *T. bottae limitaris* Goldman, *Thomomys sturgisi* Goldman, *T. umbrinus analogus* Goldman, *T. u. durangi* Nelson and Goldman, *T. u. goldmani* Merriam, *T. u. perditus* Merriam, and *T. u. potosinus* Nelson and Goldman.

Bailey (N. Amer. Fauna, 39:33, November 15, 1915) and Goldman (N. Amer. Fauna, 59:2-6, 1947) have pointed out features useful in distinguishing the two species, *T. bottae* and *T. umbrinus.* Some of the characters used by me to differentiate these two species in northeastern México and Trans-Pecos Texas are: Curvature of the margin of the anterior base of the maxilla (maxillary arm of the zygomatic arch) where it meets the frontal (in *bottae* this margin is convex, in *umbrinus* it is concave or emarginate); extent of attachment of the lachrymal, in dorsal aspect, to the maxillary arm of the

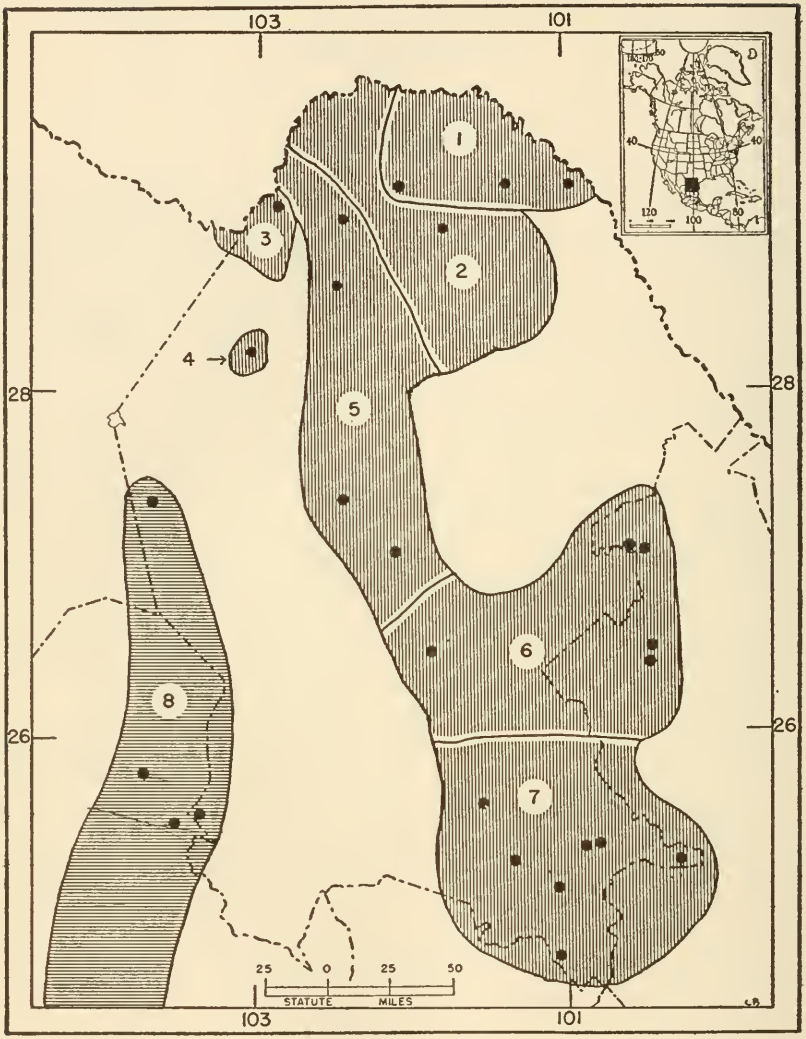

FIG. 1.—Geographic ranges of species and subspecies of pocket gophers of the genus *Thomomys* in Coahuila and adjacent Mexican states.

1. *Thomomys bottae humilis*
2. *Thomomys bottae retractus*
3. *Thomomys bottae villai*
4. *Thomomys bottae angustidens*
5. *Thomomys bottae sturgisi*
6. *Thomomys bottae perditus*
7. *Thomomys bottae analogus*
8. *Thomomys umbrinus goldmani*

zygomatic arch (in *bottae* approximately one-half of the lachrymal is attached and in *umbrinus* three-fourths or more of the lachrymal is attached to the zygomatic arch); and in *bottae* in decurved or moderately procumbent incisors *versus* strongly procumbent inci-

sors in *umbrinus*. Other characters frequently used to distinguish these species, for example, the degree of expansion of the maxillary arm of the zygomatic arch at the jugal, the shape of the nasals and the degree of ruggedness of the cranium, seem less useful.

By using principally the distinguishing characters mentioned above and with a better knowledge of geographic variation obtained by study of the new material of *Thomomys* from Coahuila, I conclude that *Thomomys sturgisi* is only subspecifically different from *T. bottae* and should be known as *Thomomys bottae sturgisi* and that *Thomomys umbrinus analogus* and *Thomomys umbrinus perditus* belong to the species *T. bottae* and should be known as *Thomomys bottae analogus* and *Thomomys bottae perditus*.

I am indebted to those in charge of collections of the Biological Surveys Collection of the United States National Museum (BSC) and the University of California Museum of Vertebrate Zoology (MVZ) for permission to examine pertinent specimens of pocket gophers. Capitalized color terms are those of Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912. Comparisons have been made, where possible, by using individuals of the same sex and of approximately the same age; in the case of color of pelage, where possible, only specimens taken at approximately the same time of year have been used in comparisons. Assistance with field work is acknowledged from the Kansas University Endowment Association and the National Science Foundation.

The following account of the pocket gophers of the genus *Thomomys* of Coahuila includes descriptions of four previously unknown subspecies of *T. bottae*. The geographic distribution of *Thomomys* in this Mexican state is shown in figure 1. Measurements are given in table 1.

Thomomys bottae humilis new subspecies

Type.—Male, adult, skin and skull, No. 35746, Univ. Kansas Mus. Nat. Hist.; 3 mi. W Hda. [Hacienda] San Miguel, 2200 ft., Coahuila; 4 April 1950; obtained by J. R. Alcorn, original number 11039.

Range.—Extreme north-central Coahuila along the Río Grande from at least as far east as the vicinity of Villa Acuña to as far west and southwest as the lower slopes and lower valleys of the Serranías del Burro (see figure 1).

Diagnosis.—Size medium for the species (see measurements, table 1); upper parts (fresh pelage, April) in general aspect buffy brown with slight olivaceous tinge, tips of hairs near (*a*) Wood Brown; underparts buffy to pale brownish; rostrum narrow; nasals gradually narrowed posteriorly with ends usually truncate; tympanic bullae medium in size and moderately inflated.

Comparisons.—From *Thomomys bottae limitaris,* topotypes and other specimens previously studied and recorded by Goldman (Jour. Washington Acad. Sci., 26:118, March 15, 1936) and by Borell and Bryant (Univ. California Publ. Zool., 48:21-22, August 7, 1942) from Brewster County, Texas, found to the north and northwest across the Río Grande, *T. b. humilis* differs in: Upper parts darker, less pale buff and tinged slightly with olivaceous; underparts usually more washed with buff and pale brown; skull smaller and narrower; rostrum narrower; tympanic bullae smaller; incisors usually less procumbent. From topotypes of *Thomomys bottae sturgisi* to the west beyond the Serranías del Burro, *T. b. humilis* differs in: Size larger; color paler; skull larger and broader; rostrum narrower; tympanic bullae smaller; pterygoid processes heavier; incisors usually more procumbent. From topotypes and near topotypes of *Thomomys bottae perditus* to the southeast, *T. b. humilis* differs in: Size larger; color more olivaceous and less pinkish buff; skull usually larger with more inflated cranium; tympanic bullae usually smaller. For comparison with the subspecies of *Thomomys bottae* in the Serranías del Burro, see the account of that subspecies to follow.

Remarks.—*Thomomys bottae humilis,* as now known, occupies the desert lowlands of extreme north-central Coahuila. *Thomomys bottae humilis* seems not to be closely related to topotypes of *T. b. limitaris* across the Río Grande. However, one specimen of *limitaris* from Comstock, Texas (BSC 108607), resembles *humilis* in many ways, both cranially and in external features, and suggests that the Río Grande, at least in the vicinity of Comstock and Villa Acuña, may not be a complete barrier to these pocket gophers. *Thomomys bottae humilis* resembles most closely pocket gophers found in the Serranías del Burro, described in an account that follows. Two specimens (KU 35748 and 35749) from Cañon del Cochino are assigned to *humilis* but show evidence of intergradation with specimens from the Burros. These two pocket gophers were trapped at 3200 feet elevation in a low valley toward the northeast side of the mountains.

All specimens here assigned to *T. b. humilis* were trapped in early April of 1950. Sign indicated that these animals occur in small groups, which are widely separated. In the vicinity of Villa Acuña only one small colony was found; it was in heavy clay soil supporting open mesquite brush. Mounds were inconspicuous and appeared old. In the vicinity of Hacienda San Miguel the pocket gophers were numerous in rocky soil where lechuguilla was the

dominant plant. Southeast of Villa Acuña, along the road to Piedras Negras, no sign of *Thomomys* has been observed by zoologists from the University of Kansas. Possibly this pocket gopher occurs no farther southeastward, at least along the Río Grande, than one mile south and nine miles west of Villa Acuña.

Weights of five adult males averaged 95.8 grams (76.8-114.4) and two young adult females weighed 72.9 and 76.0 grams. Females trapped in April contained no embryos.

Specimens examined.—Total, 8, all in the University of Kansas Museum of Natural History, from Coahuila: 1 mi. S and 9 mi. W Villa Acuña, 3; 3 mi. W Hda. San Miguel, 2200 ft., 3; Cañon del Cochino, 3200 ft., 16 mi. N and 21 mi. E Piedra Blanca, 2.

Comparative material. — Thomomys bottae limitaris: Total, 12, all from Texas as follows: Upton County: Castle Mts., 1 (BSC). Brewster County: Marathon, 15 mi. S, 1 (BSC); E base Burro Mesa, 3500 ft., 2 (MVZ); Green Gulch, 5200 ft., Chisos Mts., 2 (MVZ); Glen Spring, 2606 ft., 1 (MVZ); Boquillas, 1800 ft., 2 (1 BSC, 1 MVZ). Val Verde County: Devils River, 13 mi. below Juno, 1 (BSC); Samuels, 17 mi. W Langtry, 1 (BSC); Comstock, 1 (BSC).

Thomomys bottae villai new subspecies

Type.—Female, adult, skin and skull, No. 44816, Univ. Kansas Mus. Nat. Hist.; 7 mi. S and 2 mi. E Boquillas, 1800 ft., Coahuila; 1 March 1952; obtained by Rollin H. Baker, original number 1816.

Range.—Desert lowlands bordering the south side of the Río Grande and the Arroyo de los Alamos in extreme northwestern Coahuila, eastward no farther than the beginnings of the higher lands of the Sierra del Carmen and related ranges, westward along the Río Grande possibly into Chihuahua (see figure 1).

Diagnosis.—Size medium for the species (see measurements, table 1); upper parts (fresh pelage, March) pale cinnamon buff in over-all effect, but tips of hairs near (*h*) Cinnamon; underparts white to pale buff; dorsal face of rostrum flattened and slightly dished in older adults; tympanic bullae relatively large and inflated; interpterygoid space V-shaped.

Comparisons. — From topotypes and other specimens from Brewster County, Texas, of *Thomomys bottae limitaris,* found to the north directly across the Río Grande, *T. b. villai* differs in: Color lighter, duller and less richly tinged with bright buff; dorsal face of base of rostrum more nearly flat and more dished; tympanic bullae usually larger and more inflated; apex of interpterygoid space narrowly, instead of broadly, V-shaped. From topotypes of *T. b. sturgisi,* found to the south and east, *T. b. villai* differs in: Body larger; hind foot averaging larger; color much lighter both on upper parts and underparts; skull broader and more inflated; dorsal face of base of rostrum more nearly flat; zygomatic arches more widely flaring; tympanic bullae larger and more inflated; pterygoid processes heavier; incisors more procumbent. From topotypes of

T. b. humilis, T. b. villai differs in: Color much lighter on upper parts and to a lesser extent on underparts; skull with rostrum broader; nasals less wedge-shaped posteriorly; zygomatic arches more widely flaring; tympanic bullae larger and more inflated; apex of interpterygoid space generally more narrowly V-shaped; incisors more procumbent.

Remarks.—Thomomys bottae villai has a seemingly restricted range in northwestern Coahuila, occupying the desert lowlands directly west of the Sierra del Carmen and associated ranges. These ranges bar the movements of this animal downstream along the Río Grande since the mountains meet the river abruptly forming the deeply cut Cañon de Boquillas, where no habitable terrain is available to lowland pocket gophers. In these mountains there is another subspecies, *T. b. sturgisi. Thomomys b. villai* may occur westward into Chihuahua and possibly southward in the wide valley of the Arroyo de los Alamos.

Thomomys b. villai is most nearly like *T. b. limitaris* in coloration and in some cranial characters, but is a recognizable subspecies. The type localities of these two subspecies are less than 10 miles apart, but the Río Grande separates them. The river, even though shallow at times, is seemingly an effective barrier to pocket gophers. In this area parts of the Río Grande are entrenched in deep canyons or at least are bordered by rocky cliffs, allowing no chance for meandering to change the course of the stream. Therefore, there is little chance that land occupied by pocket gophers will become islands or a part of the opposite bank and thus allow for some interchange between the two populations.

The series of *T. b. villai* was taken at a single locality in late February and early March of 1952. Although the field party taking these specimens was camped at various localities in the vicinity of Boquillas, Coahuila, for 16 days, no other sign of pocket gophers was found. These animals were taken from burrows under thick stands of lechuguilla, a dominant plant over much of the area, especially on slight elevations and slopes. The pocket gophers seem to subsist almost entirely on lechuguilla. They tunnel up under the plants and feed on the roots and basal parts, often pulling the plant, partly or entirely, into their burrows. Fresh mounds were nowhere conspicuous. Evidence of the presence of pocket gophers, however, was often shown by clumps of dead lechuguilla or partly buried plants. Weights of two adult males are 107.2 and 118.6 grams; of three adult females, 93.2, 99.0 and 100.0 grams.

None of the females, taken in February and March, contained embryos.

This animal is named for Professor Bernardo Villa-Ramirez in recognition of his work on Mexican mammals.

Specimens examined. — Total, 9, all in University of Kansas Museum of Natural History, from Coahuila: 7 mi. S and 2 mi. E Boquillas, 1800 ft., 9.

Thomomys bottae retractus new subspecies

Type.—Male, adult, skin and skull, No. 44826, Univ. Kansas Mus. Nat. Hist.; Fortín, 3300 ft., 33 mi. N and 1 mi. E San Gerónimo, Coahuila; 29 March 1952; obtained by Rollin H. Baker, original number 1971.

Range.—Serranías del Burro of north-central Coahuila (see figure 1).

Diagnosis.—Size medium for the species (see measurements, table 1); upper parts near (*c*) Pale Pinkish Cinnamon, darker at midline; underparts buffy; skull large; rostrum narrow; zygomata widely flaring.

Comparisons. — From topotypes of *Thomomys bottae humilis,* found to the north and northeast, *T. b. retractus* differs in: Size larger; upper parts slightly darker; skull larger and broader; zygomata more widely flaring; rostrum longer; nasals generally more wedged-shaped and emarginate posteriorly; tympanic bullae larger. From topotypes of *Thomomys bottae sturgisi,* found to the west and southwest, *T. b. retractus* differs in: Size larger; skull larger and broader; rostrum narrower; braincase more expanded; zygomata more widely flaring; pterygoid processes heavier; upper incisors more procumbent; upper molariform tooth-row shorter in relation to basilar length. From topotypes and near topotypes of *Thomomys bottae perditus,* found to the southeast, *T. b. retractus* differs in: Size larger; skull larger and heavier; rostrum longer; interorbital space narrower; interpterygoid space more V-shaped and less U-shaped.

Remarks.—Thomomys bottae retractus is known from one locality in the Serranías del Burro, a relatively low but extensive mountain range in north-central Coahuila, and probably occurs throughout this mountainous area but seemingly not in other places. Specimens were trapped in dark soils supporting mixed stands of an oak and two pines. This mountain range is separated from the Sierra del Carmen by lowlands, including the Arroyo de la Babia, from which no *Thomomys* have been taken. Lowlands to the southeast may isolate *T. b. retractus* from *T. b. perditus* of the Sierra Madre Oriental. To the north there is a lowland pocket gopher, *T. b. humilis,* which intergrades with *retractus* in the foothills of the Burros. Two specimens assigned to *humilis* from the Cañon del Cochino tend toward *retractus* especially in length of

rostrum. Two adult males weighed 110.0 and 119.7 grams; two adult females weighed 83.0 and 84.0 grams. None of the five females, all taken in March, contained embryos.

Specimens examined.—Total, 8, all in the University of Kansas Museum of Natural History, from Coahuila: Fortín, 3300 ft., 33 mi. N and 1 mi. E San Gerónimo, 8.

Thomomys bottae angustidens new subspecies

Type.—Male, adult, skin and skull, No. 48481, Univ. Kansas Mus. Nat. Hist.; Sierra del Pino, 5250 ft., 6 mi. N and 6 mi. W Acebuches, Coahuila; 3 July 1952; obtained by Rollin H. Baker, original number 2141.

Range.—Sierra del Pino of northwestern Coahuila and probably other isolated desert ranges in the vicinity, west of the Sierra de la Encantada (see figure 1).

Diagnosis.—Size small for the species (see measurements, table 1); upper parts (fresh pelage, July) Pale Pinkish Cinnamon, darker at midline; underparts buffy; skull short and broad; rostrum narrow; alveolar base of upper molariform tooth-row short.

Comparisons.—From topotypes of *Thomomys bottae villai,* found to the north, *T. b. augustidens* differs in: Size smaller; upper parts slightly darker; underparts more buffy; hind foot averaging smaller; skull smaller; rostrum narrower; braincase more smoothly rounded; incisors less procumbent; alveolar base of upper molariform tooth-row averaging shorter. From topotypes of *Thomomys bottae sturgisi,* to the northeast, *T. b. angustidens* differs in: Upper parts paler and more buffy; skull less elongate and wider; rostrum narrower; pterygoid processes heavier; incisors less decurved and slightly more procumbent; alveolar base of upper molariform tooth-row averaging shorter.

Remarks.—*Thomomys bottae angustidens* is known from two localities in the Sierra del Pino but may, logically, occur in other desert mountain ranges in the vicinity. These pocket gophers were found in dark soils at 5250 feet and 7925 feet elevation. One specimen (KU 48480) is in the dark phase and has a noticeably short tail, 47 mm. in length. These specimens have been compared with topotypes of *T. b. villai* and *T. b. sturgisi,* the only pocket gophers of this species which are immediately adjacent in range. In color, *angustidens* seems closer to *villai.* Neither of two females, taken in July, contained embryos.

Specimens examined.—Total, 5, all in the University of Kansas Museum of Natural History, from Coahuila: Sierra del Pino, 5250 ft., 6 mi. N and 6 mi. W Acebuches, 3; Sierra del Pino, 7925 ft., 5 mi. N and 9 mi. W Acebuches, 2.

Thomomys bottae sturgisi Goldman

1938. *Thomomys sturgisi* Goldman, Proc. Biol. Soc. Washington, 51:56, March 18, type from Carmen Mountains, 6000 ft., Coahuila, México.

Range.—Mountains and elevated plains of north-central Coahuila from as far south as Ocampo and Cuatro Cienegas northward probably to the northern limits of the Sierra del Carmen at the south side of the Río Grande (see figure 1).

Remarks.—Goldman (Proc. Biol. Soc. Washington, 51:56, March 18, 1938) described this pocket gopher as a full species based on two specimens obtained within the holdings of the Club Sierra del Carmen, a private hunting club. He found this pocket gopher to be allied with *Thomomys bottae,* with relationships to the subspecies, *limitaris,* of the Big Bend of Texas. In early April of 1950 six more of these animals were trapped by a University of Kansas Museum of Natural History field party near the headquarters of the club, possibly at the same place where Goldman's material was trapped.

Goldman (*op. cit.*:57) regarded *sturgisi* as darker than either *T. b. limitaris* or *T. umbrinus* [= *bottae*] *perditus,* and concerning the skull writes: "Similar in size to that of *limitaris,* but more slender; rostrum and nasals narrower; interorbital region more constricted; palate narrower; upper incisors narrower, thinner, more strongly recurved. Compared with that of *perditus,* the skull is similar in size, but narrower; nasals longer; zygomata narrower; rostrum deeper anteriorly; nasals [= incisors] strongly recurved instead of strongly procumbent."

Six topotypes of *sturgisi* compared with topotypes of *limitaris* and *perditus* show substantially the same differences as were found by Goldman. Most of these six specimens are in molt; the color of the new pelage agrees with that described for *sturgisi* by Goldman, although in one specimen, an adult male (KU 35753), the color of the new pelage on the sides of the rump is significantly brighter and the tips of the hairs are near (*a*) Clay Color. In addition, *sturgisi* has a broader rostrum than does *perditus.*

Other pocket gophers here assigned to *sturgisi* differ somewhat in color and cranial features from the topotypes at hand. Most of the specimens from the Sierra de la Encantada (37 mi. S and 21 mi. E Boquillas, 4100 ft. and 38 mi. S and 23 mi. E Boquillas, 4400 ft.) are of the same color as topotypical *sturgisi* but some are paler. In cranial features most of the specimens differ from topotypes as follows: Skull slightly larger and broader; pterygoids heavier; tympanic bullae slightly larger. A young adult female (KU 48483) from the arid elevated plain in the vicinity of Ocampo (2 mi. N and 1 mi. W Ocampo, 4050 ft.) is best referred to *sturgisi* but shows some relationship to *perditus* to the southwest and to *angustidens*

to the northwest in coloration and dimensions of the skull; the skull is slightly broader and the rostrum narrower than in topotypes of *sturgisi*. Part of a cranium (KU 51677) from an owl pellet taken 3 miles northwest of Cuatro Cienegas, 2450 ft., is tentatively referred to *sturgisi*. Bone fragments identified as *Thomomys umbrinus* by Gilmore (Jour. Mamm., 28:151 and 158, 1947) from a prehistoric cave site in the vicinity of Cuatro Cienegas (approximately 16 mi. E and 4 mi. S, 3900 ft. elevation) also are tentatively referred by me to *T. bottae sturgisi*.

It would seem, therefore, that typical *T. b. sturgisi* is found only in the igneous-capped Sierra del Carmen whereas populations of pocket gophers from areas to the southward, where the rocks are entirely of limestone, show some divergence in color and are generally larger with larger and broader skulls, thereby showing some relationship with other, adjacent subspecies of *bottae*.

Weights of two adult males (topotypes) are 82.5 and 87.6 grams, and of two adult females (topotypes) 63.2 and 69.5 grams. Weights of adults from the Sierra de la Encantada are: One male, 93.0 grams; three females, 64.1, 79.6 and 82.8 grams. Ten females, taken in March and April, contained no embryos. Measurements of *T. b. sturgisi* are given in table 1.

Specimens examined.—Total, 15, all in the University of Kansas Museum of Natural History, from Coahuila: Club Sierra del Carmen, 4950 ft., 2 mi. N and 6 mi. W Piedra Blanca, 6; Sierra de la Encantada, 4100 ft., 37 mi. S and 21 mi. E Boquillas, 1; Sierra de la Encantada, 4400 ft., 38 mi. S and 23 mi. E Boquillas, 6; 2 mi. N and 1 mi. W Ocampo, 4050 ft., 1; 3 mi. NW Cuatro Cienegas, 2450 ft., 1.

Thomomys bottae perditus Merriam

1901. *Thomomys perditus* Merriam, Proc. Biol. Soc. Washington, 14:108, July 19, type from Lampazos, Nuevo León.

1934. *Thomomys umbrinus perditus* Nelson and Goldman, Jour. Mamm., 15:115, May 15.

Range.—Mtns. of western Nuevo León and east-central Coahuila (fig. 1.).

Remarks.—*Thomomys bottae perditus,* according to current knowledge, occurs only at higher elevations in the northern Sierra Madre Oriental of Nuevo León and east-central Coahuila. Two specimens from the Sierra de San Marcos (2 mi. N and 18 mi. W Santa Teresa, 7500 ft.) are here assigned to *T. b. perditus* on the basis of cranial characters; both specimens are in a dark phase of pelage. They approach typical *perditus* in most cranial features including size and alveolar length of the upper molariform toothrow. These pocket gophers from the Sierra de San Marcos do show some tendency toward *T. b. sturgisi,* especially in breadth of ros-

trum, thus forming a connecting link between pocket gophers from northwestern Coahuila and those to the southeast. Measurements are given in table 1.

Specimens examined.—Total, 7, all in the University of Kansas Museum of Natural History except those indicated as being in the Biological Surveys Collection (BSC), from Coahuila: 2 mi. N and 18 mi. W Santa Teresa, 7500 ft., 2. Nuevo León: Lampazos, 18 mi. W, 1 (BSC); Lampazos, 2 (BSC); Villadama [= Villaldama], 1 (BSC); Villadama [= Villaldama], 10 mi. S, 1 (BSC).

Thomomys bottae analogus Goldman

1938. *Thomomys umbrinus analogus* Goldman, Proc. Biol. Soc. Washington, 51:59, March 18, type from Sierra Guadalupe, southeastern Coahuila.

Range.—Mountains and elevated plains of southeastern Coahuila. Probably found in adjacent mountainous parts of Nuevo León, San Luis Potosí and possibly Zacatecas (see figure 1).

Remarks.—Goldman (Proc. Biol. Soc. Washington, 51:59, March 18, 1938) described *Thomomys umbrinus* [= *bottae*] *analogus* using specimens referred earlier to *perditus* by Bailey (N. Amer. Fauna, 39:95, November 15, 1915). Goldman (*loc. cit.*) described *analogus* as darker than *perditus* and concerning the skull writes: "Very similar to that of *perditus*, but nasals decidedly broader, less wedge-shaped posteriorly; interparietal larger; auditory bullae slightly smaller, less rounded and inflated." In comparing new material in the University of Kansas Museum of Natural History, assigned herein to *analogus*, with *perditus*, the tympanic (auditory) bullae seem no smaller but the skulls are larger and broader.

This subspecies has been found in a greater variety of habitats than other pocket gophers of the genus *Thomomys* in Coahuila. The vertical range is from a little less than 4000 feet at Jaral to at least 9000 feet in the Sierra Madre Oriental.

Measurements are given in table 1. Weights of four adult males averaged 113.1 grams (100.5-136.9). One adult female weighed 92.0 grams; another, taken on July 30, and containing four embryos, weighed 115.0 grams.

Specimens examined.—Total, 25, all in the University of Kansas Museum of Natural History except those indicated as being in the Biological Surveys Collection (BSC), from Coahuila: Jaral, 3860 ft., 1 (BSC); 5 mi. E and 2 mi. S Saltillo, 9000 ft., 1; Diamante Pass, 8500 ft., 3 mi. E and 4 mi. S Saltillo, 5; 4 mi. S and 6 mi. E Saltillo, 7500 ft., 1; 1 mi. S and 4 mi. W Bella Unión, 7000 ft., 4; 2 mi. SE Bella Unión, 5850 ft., 1; 12 mi. E San Antonio de las Alazanas, 9000 ft., 6; Sierra Guadalupe, 2 (BSC); Carneros, 3 (BSC); Sierra Encarnación, 9000 ft., 1 (BSC).

Thomomys umbrinus goldmani Merriam

1901. *Thomomys goldmani* Merriam, Proc. Biol. Soc. Washington, 14:108, July 19, type from Mapimí, Durango.

1934. *Thomomys umbrinus goldmani* Nelson and Goldman, Jour. Mamm., 15:115, May 15.

Range.—Western and southwestern Coahuila and south into northeastern Durango (see figure 1).

Remarks.—Two specimens from Coahuila (3 mi. SE Torreón, 3800 ft.), across the Río Nazas from Durango, are referred to *T. u. goldmani* although the upper parts are brighter than in topotypes; also, the skulls are generally narrower with less expanded zygomatic arches. These specimens extend the known range of *goldmani* into Coahuila.

Two other specimens from extreme western Coahuila (3 mi. NE Sierra Mojada, 4100 ft.), approximately 130 miles north of Torreón, closely resemble *T. u. goldmani* and are tentatively referred to that subspecies. They differ from *goldmani* in that the color of the upper parts is duller; the adult female (KU 40864) has upper parts near (*a*) Avellaneous and the younger female (KU 40865) has upper parts less pale and more nearly (15) Vinaceous-Faun. Also the upper incisors are less procumbent. From a topotype and other specimens as listed below of *Thomomys baileyi nelsoni,* found to the west in Chihuahua, these two pocket gophers differ in: Size smaller; upper parts darker and duller with a tinge of olivaceous; skull smaller and narrower; upper incisors less procumbent; rostrum less depressed anteriorly; lachrymal in dorsal aspect with approximately one-half instead of three-fourths of its length attached to anterior arm of zygomatic arch. From topotypes of *Thomomys bottae angustidens,* found to the northeast, these two specimens differ in: Upper parts duller and browner; skull broader and more arched; rostrum more depressed anteriorly, nasals more wedge-shaped; upper incisors thinner and more procumbent. These two specimens from the vicinity of Sierra Mojada resemble *bottae,* and differ from *umbrinus,* in having the border of the anterior arm of the zygomatic arch, where it meets the frontal, slightly convex and in having approximately one-half of the lachrymal, in dorsal aspect, attached to the anterior arm of the zygomatic arch. In other ways, these two pocket gophers from the vicinity of the pueblo of Sierra Mojada resemble *umbrinus,* especially in the arched condition of the skull. Measurements of this subspecies are given in table 1.

Specimens examined.—Total, 8, all in the University of Kansas Museum of Natural History, from Coahuila: 3 mi. NE Sierra Mojada, 4100 ft., 2; 3 mi. SE Torreón, 3800 ft., 2. Durango: 1 mi. WSW Mapimí, 3800 ft., 3; 4 mi. WSW Lerdo, 3800 ft., 1.

Comparative material.—Thomomys baileyi nelsoni. Total, 5, all in the University of Kansas Museum of Natural History, except those indicated as being in the Biological Surveys Collection (BSC), from Chihuahua: Gallego, 1 (BSC); 1 mi. NW Camargo, 4000 ft., 3; Parral, 1 (BSC).

TABLE 1. MEASUREMENTS (IN MILLIMETERS) OF ADULT THOMOMYS

Sex	Catalogue number	Total length	Length of tail	Length of hind foot	Basilar length	Zygomatic breadth	Interorbital breadth	Squamosal breadth	Length of nasals	Breadth of rostrum	Alveolar length of upper molariform tooth-row
		Thomomys bottae analogus, topotype (BSC)									
♂	116995	190	68	28	29.3	21.3	6.8	17.2	.....	6.3	7.4
		Jaral (BSC)									
♀	51023	200	66	27	29.2	.....	7.1	16.9	11.5	6.0	6.8
		4 mi. S and 6 mi. E Saltillo, 7500 ft. (KU)									
♂	35762	216	63	28	33.0	24.7	6.8	19.7	14.5	7.5	7.5
		1 mi. S and 4 mi. W Bella Union, 7000 ft. (KU)									
♂	34581	200	58	25	30.6	22.8	6.4	18.0	13.7	6.3	7.2
♂	34582	212	65	26	31.2	22.9	6.6	18.1	13.5	6.4	6.9
		2 mi. SE Bella Union, 5850 ft. (KU)									
♂	48484	210	68	31	32.9	23.5	6.8	18.9	13.8	6.7	7.7
		12 mi. E San Antonio de las Alazanas, 9000 ft. (KU)									
♂	33115	213	66	27	30.7	21.7	6.8	18.0	.....	6.8	7.0
♀	33112	205	58	27	31.3	22.6	6.9	18.5	12.6	6.9	7.0
♀	33113	184	60	28	30.1	21.6	6.5	17.7	12.3	6.7	6.8
		Carneros, about 6800 ft. (BSC)									
♂	79656	200	56	27.5	30.0	22.4	6.3	17.8	13.0	6.4	7.2
		Sierra Encarnacion, about 9000 ft. (BSC)									
♀	79504	197	66	27	29.6	.....	6.8	16.7	12.1	6.5	7.3
		Thomomys bottae angustidens, type (KU)									
♂	48481	198	64	27	29.6	20.8	7.0	17.8	12.3	6.9	7.1
		Sierra del Pino, 7925 ft., 5 mi. N and 9 mi. W Acebuches (KU)									
♂	48480	174	47	26	29.9	20.7	6.0	17.6	12.7	5.9	6.5
♀	48479	189	64	26	27.7	18.8	6.2	16.4	11.1	6.0	6.4
		Thomomys bottae humilis, type and topotype (KU)									
♂	35746	197	55	27	30.8	22.3	6.7	18.8	11.7	6.9	7.2
♂	35747	200	55	27	30.7	21.0	6.4	17.2	12.2	6.1	7.2
		1 mi. S and 9 mi. W Villa Acuña (KU)									
♂	35743	188	52	24	29.4	21.1	6.1	17.5	12.0	7.2	6.7
♂	35744	201	63	27	29.0	20.6	6.7	16.3	11.2	6.0	7.0
		Cañon del Cochino, 3200 ft., 16 mi. N and 21 mi. E Piedra Blanca (KU)									
♂	35749	196	57	27	29.6	21.9	6.3	18.3	12.4	6.5	6.8
		Thomomys bottae perditus, topotype (BSC)									
♀	25609/ 33002	189	60	24	.....	.....	6.8	.....	11.0	6.1	.....

TABLE 1.—CONCLUDED

Sex	Catalogue number	Total length	Length of tail	Length of hind foot	Basilar length	Zygomatic breadth	Interorbital breadth	Squamosal breadth	Length of nasals	Breadth of rostrum	Alveolar length of upper molariform tooth-row
		Lampazos, 18 mi. west, Nuevo Leon (BSC)									
♀	25608/ 33001	172	48	25	27.9	20.8	6.2	16.6	11.2	6.1	6.9
		Villadama [=Villaldama], 10 mi. south, Nuevo Leon (BSC)									
♀	25604/ 32997	190	65	27	28.6	20.4	6.9	16.3	11.0	6.0	6.7
		2 mi. N and 18 mi. W Santa Teresa, 7500 ft., Coahuila (KU)									
♂	44837	187	57	24	30.1	21.4	6.3	17.2	13.4	6.7	6.6
		Thomomys bottae retractus, type and topotypes (KU)									
♂	44822	220	74	27	33.6	24.1	6.1	18.9	14.0	7.5	7.2
♂	44826	220	74	28	32.8	23.6	6.7	18.4	13.9	6.8	7.1
♀	44823	192	58	24	29.6	21.0	6.2	17.5	12.4	6.3	6.7
♀	44828	205	71	27	30.2	21.1	6.6	17.0	11.7	7.2	6.7
		Thomomys bottae sturgisi, topotypes (KU)									
♂	35750	192	[48]	27	29.7	20.5	6.6	16.4	12.7	6.8	7.2
♂	35753	204	68	27	29.8	20.5	6.5	17.1	12.3	6.7	7.1
♀	35752	194	65	26	27.2	18.8	6.2	16.1	10.9	5.9	6.6
♀	35755	199	64	25	28.5	19.7	6.5	16.6	11.5	6.4	7.0
		Sierra de la Encantada, 4400 ft., 38 mi. S and 23 mi. E Boquillas (KU)									
♂	44833	203	60	27	29.1	21.5	6.7	18.1	12.2	7.2	7.5
♀	44829	196	60	25	29.1	20.3	6.4	16.9	11.8	6.7	6.9
♀	44830	191	60	26	29.4	20.7	6.1	17.7	11.7	6.2	7.0
♀	44835	175	52	23	27.7	19.9	6.6	16.8	11.5	6.4	6.9
		Thomomys bottae villai, type and topotypes (KU)									
♂	44813	194	56	28	31.0	22.2	6.9	18.5	12.2	7.2	7.3
♂♀	44818	.....	.....	.....	31.6	22.8	6.4	18.5	.....	7.3	7.1
♂♀	44820	196	61	29	32.5	23.6	6.4	18.6	12.6	7.5	6.8
♀	44815	209	65	27	30.4	21.7	6.8	18.0	11.8	7.2	6.7
♀	44816	210	68	28	31.6	21.6	6.4	18.5	12.2	7.2	7.3
♀	44819	213	66	28	30.1	21.1	6.4	18.4	11.4	6.5	7.1
		Thomomys umbrinus goldmani, 1 mi. WSW Mapimi, 3800 ft., Durango (KU)									
♀	40214	176	56	25	28.0	21.7	6.5	17.9	10.5	5.6	6.8
♀	40215	201	69	25	31.7	22.4	6.5	17.5	12.4	6.1	7.0
		3 mi. SE Torreon, 3800 ft., Coahuila (KU)									
♂	40212	193	61	27	30.2	20.2	6.5	17.2	10.9	6.4	7.0
		3 mi. NE Sierra Mojada, 4100 ft. (KU)									
♀	40864	192	58	26	30.3	21.2	6.4	18.1	11.7	5.8	7.1

Transmitted February 19, 1953.

Geographic Distribution of the Pocket Mouse, Perognathus fasciatus

BY

J. KNOX JONES, JR.

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Geographic Distribution of the Pocket Mouse, Perognathus fasciatus

BY

J. KNOX JONES, JR.

In his "Revision of the pocket mice of the genus Perognathus," Osgood (1900:18-20) reviewed the distribution, as then known, of *Perognathus fasciatus* and recognized two geographic races—*Perognathus fasciatus* [*fasciatus*] Wied-Neuwied in eastern Montana and Wyoming and adjacent parts of North and South Dakota, and *Perognathus fasciatus infraluteus* Thomas, known only from the type locality at Loveland, Larimer County, Colorado. Later, Cary (1911: 61) described *Perognathus fasciatus litus* as a pale subspecies occurring in the lower Sweetwater Valley and adjacent parts of the Red Desert of south-central Wyoming. After 1911 no important taxonomic contributions dealing with *Perognathus fasciatus* appeared.

In studying the kinds of pocket mice known from Nebraska, I examined thirteen specimens of *P. fasciatus* from the northwestern part of the state which did not agree satisfactorily with the descriptions of any known subspecies of *fasciatus*. This impelled me to examine material from the entire range of *P. fasciatus*. This examination revealed that: (1) *Perognathus callistus* Osgood, heretofore considered to be a full species, should be reduced to subspecific rank under *P. fasciatus;* and (2) specimens from eastern Wyoming and adjacent parts of Montana, South Dakota and Nebraska represent an heretofore unrecognized subspecies. Further investigation, however, revealed that *Perognathus flavescens olivaceogriseus* Swenk, described from northwestern Nebraska (Swenk, 1940:6), is not *flavescens* but actually *fasciatus*. Since the specimens on which Swenk's description was based were taken within the range of this newly recognized subspecies, and since my examination of the holotype shows it to be of the species *Perognathus fasciatus,* the subspecific name *olivaceogriseus* is available.

The subspecies of *P. fasciatus* are most easily distinguished by color of pelage, in which there is a general cline from northeast (dark) to southwest (pale). Cranially, the subspecies are less distinct. The skulls of *P. f. callistus* can be distinguished from those of the other subspecies by several differences; however, among the

other four subspecies, only minor cranial differences are evident. Individual variation was found to be greater than secondary sexual variation.

In connection with this study, grateful acknowledgment is made to the following persons for the loan of specimens in their care: Dr. H. E. Anthony, American Museum of Natural History (AMNH); Mr. Colin C. Sanborn, Chicago

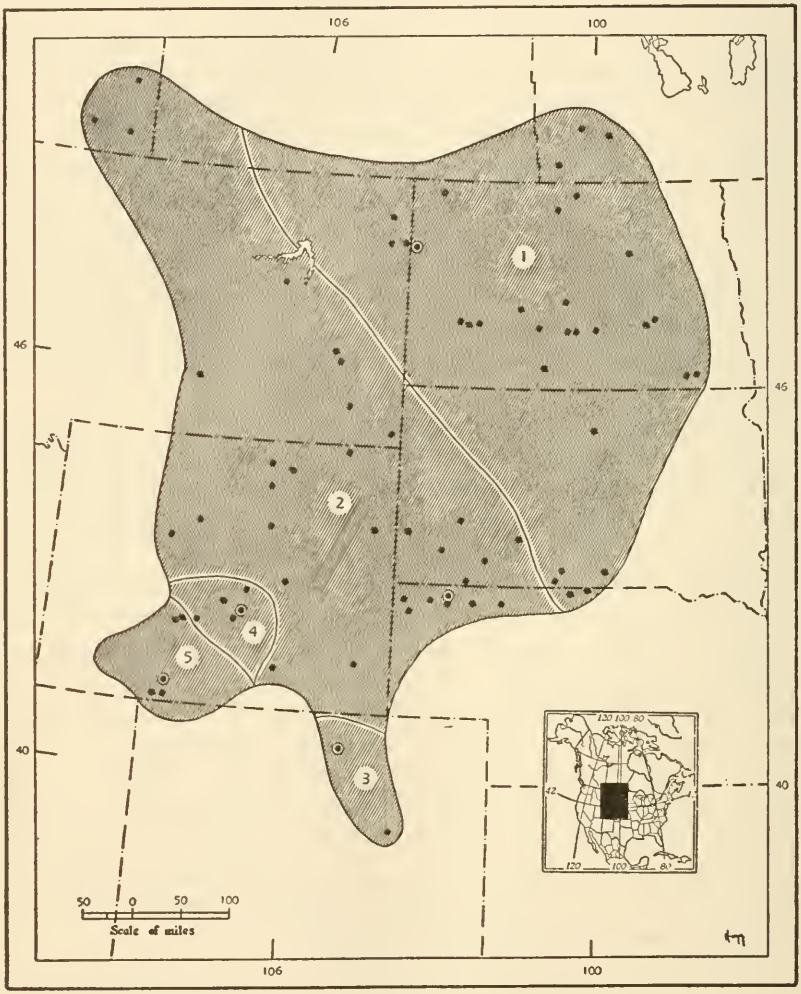


Fig. 1. Distribution of the five subspecies of *Perognathus fasciatus*. Solid symbols represent specimens examined; circled symbols represent type localities.

Guide to subspecies
1. *P. f. fasciatus*
2. *P. f. olivaceogriseus*
3. *P. f. infraluteus*
4. *P. f. litus*
5. *P. f. callistus*

Natural History Museum (CNHM); Mr. Austin W. Cameron, National Museum of Canada (NMC); Miss Viola S. Schantz, Biological Surveys Collection, U. S. National Museum (USBS); Dr. Seth B. Benson, University of California Museum of Vertebrate Zoology (MVZ); Mr. J. E. Moore, Department of Zoology, University of Alberta (UADZ); Dr. William H. Burt, University of Michigan Museum of Zoology (MZ); Dr. Otis Wade, University of Nebraska Department of Zoology (UNDZ); Dr. C. Bertrand Schultz, University of Nebraska State Museum (NSM); and to those in charge of the collections of the Nebraska Game, Forestation and Parks Commission (NGFPC). Specimens from the Museum of Natural History, University of Kansas (KU), also have been used.

Capitalized color terms are those of Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912. Assistance with field work to obtain specimens for the University of Kansas Museum of Natural History is acknowledged from the Kansas University Endowment Association and the National Science Foundation.

Perognathus fasciatus fasciatus Wied-Neuwied

Perognathus fasciatus Wied-Neuwied, Nova Acta Phys.-Med. Acad. Caesar. Leop.-Carol., 19:369, 1839, type from Upper Missouri River near its junction with the Yellowstone, near Buford, Williams County, North Dakota.

Geographic distribution. — Southwestern Manitoba, extreme northeastern Montana and all of North Dakota except extreme eastern part, south through central South Dakota to the northeastern part of Cherry County, Nebraska (see Figure 1).

Remarks.—For comparisons with *Perognathus fasciatus olivaceo-griseus*, geographically adjacent to the southwest, see account of that subspecies.

Specimens from the eastern part of the range of *P. f. fasciatus* are somewhat smaller and slightly darker than topotypes from Buford, North Dakota. Specimens from 9 mi. SE Bainville, Johnson Lake and 3 mi. S Medicine Lake, Montana, and from Crosby, North Dakota, are also paler than those from farther east. At the southern limit of the range of the subspecies, specimens from the Rosebud Agency and Minichaduza River, South Dakota, approach *olivaceo-griseus* in pale dorsal coloration.

Specimens examined.—Total number, 83, as follows: MANITOBA: Aweme, 3 (USBS 2, NMC 1). Junction of Antler and Souris rivers, 1 (NMC). Oak Lake, 2 (NMC). MONTANA: *Roosevelt County:* 9 mi. SE Bainville, 4 (MZ); Johnson Lake, 2 (USBS). *Sheridan County:* 3 mi. S Medicine Lake, 1880 ft., 1 (KU). NEBRASKA: *Cherry County:* Ft. Niobrara Game Reserve, 1 (NSM); Sparks, 1 (MZ); Valentine, 2 (UNDZ). NORTH DAKOTA: *Benson County:* 2 mi. W Fort Totten, 1400 ft., 3 (KU). *Bottineau County:* Bottineau, 1 (CNHM). *Burleigh County:* 9 mi. E Bismark, 7 (MZ). *Dickey County:* Oakes, 2 (CNHM 1, USBS 1). *Divide County:* Crosby, 1 (USBS). *Kidder County:* Dawson, 1 (USBS); 6 mi. W Steele, 6 (MZ). *McHenry County:* ½ mi. E Upham, 1 (USBS). *Morton County:* 12 mi. W Mandan, 2 (MZ). *Oliver County:* Ft. Clark, 8 (USBS). *Sargent County:* 7⅞10 mi. E, 1⅞10 mi. S Oakes, 1200 ft., 1 (KU). *Sioux County:* Cannon Ball, 6 (USBS). *Stark*

County: 1 mi. S Dickinson, 1 (MZ); 9 mi. W Dickinson, 3 (MZ); 2 mi. W Taylor, 4 (MZ). *Stutsman County:* 7 mi. N Jamestown, 1 (MZ); 14 mi. W Jamestown, 1 (MZ). *Wells County:* Bowdon, 1 (USBS). *Williams County:* Buford, 9 (USBS). South Dakota: *Todd County:* Minichaduza River, 2 (USBS); Rosebud Agency, 1 (USBS). *Tripp County:* Colome, 3 (MZ). *Walworth County:* Swan Creek, 13 mi. S Shelby, 1600 ft., 1 (KU).

Perognathus fasciatus olivaceogriseus Swenk

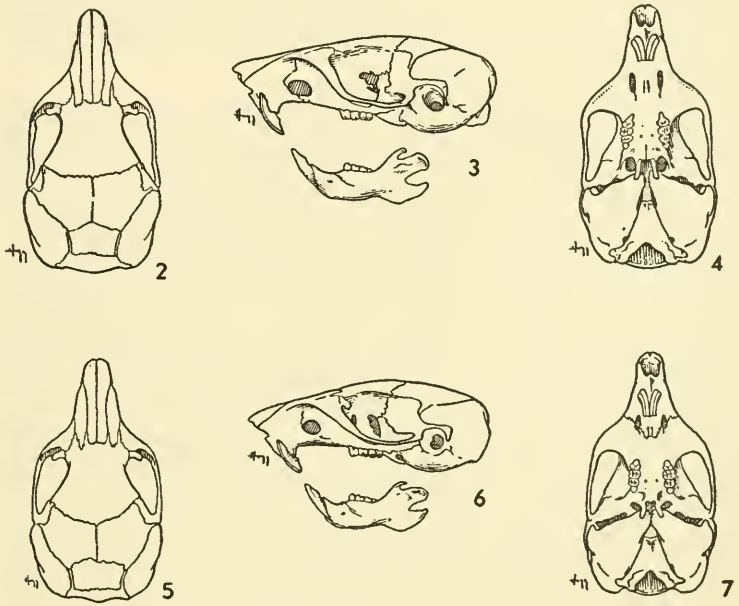
Perognathus flavescens olivaceogriseus Swenk, Missouri Valley Fauna, 3:6, June 5, 1940, type from [Little Bordeaux Creek, sec. 14, T. 33 N, R. 48 W, 3 mi. E] Chadron, Dawes County, Nebraska.

Geographic distribution.—Southeastern Alberta, southeast to eastern Wyoming and adjacent parts of South Dakota and Nebraska.

Diagnosis.—External measurements of the holotype and average and extreme external measurements of six adults (five males and one female) from several localities in eastern Wyoming are, respectively, as follows: Total length, 124, 132 (125-140); length of tail-vertebrae, 53, 63 (59-68); length of hind foot, 16.5, 17 (17-18); length of ear, 6.5, 6.6 (6.0-7.0). Color: Upper parts Cream Buff, lined with black and giving a pale olivaceous appearance; lateral line near (16*d*) Light Ochraceous-Buff; postauricular patches Cream Buff; subauricular patches and underparts white; tail indistinctly bicolor, dusky above, whitish below. Skull: Size medium for species (see Table 1); braincase and auditory bullae moderately inflated; interorbital region narrow; mastoidal region broad.

Remarks.—From topotypes of *Perognathus fasciatus fasciatus,* geographically adjacent to the northeast, *P. f. olivaceogriseus* differs in: Upper parts paler, especially face which is heavily washed with buff; hind foot smaller; skull averaging slightly smaller in all measurements taken (especially least interorbital breadth and cranial depth), except mastoidal breadth which is slightly more and interparietal breadth, length of tympanic bulla and length of maxillary tooth-row which are approximately the same. From topotypes of *Perognathus fasciatus infraluteus,* geographically adjacent to the south, *P. f. olivaceogriseus* differs in: Upper parts paler and less drab; lateral line brighter and more ochraceous; underparts never buffy; skull averaging larger in all measurements taken except interparietal breadth and length of maxillary tooth-row which are smaller. From topotypes of *Perognathus fasciatus litus,* geographically adjacent to the southwest, *P. f. olivaceogriseus* differs in: Upper parts darker; skull, when specimens of equal age are compared, averaging larger in mastoidal breadth, interparietal breadth and basal length. From topotypes of *Perognathus fasciatus callistus, P. f. olivaceogriseus* differs in: Upper parts slightly darker, pelage not silky, coarser in appearance; hind foot shorter; skull averaging smaller in all measurements taken (especially mastoidal breadth), except interparietal breadth which is more.

Swenk (*loc. cit.*) originally described *P. f. olivaceogriseus* as a subspecies of *Perognathus flavescens.* I have examined the holotype, kindly made available to me by Dr. Seth B. Benson of the Museum of Vertebrate Zoology, University of California, and the paratype, in the collection of the University of Nebraska State Museum. Neither is *P. flavescens,* but both are clearly specimens of *P. fasciatus* on the basis of olive-gray dorsal coloration, larger over-all dimensions of the skull, and in that the tympanic bullae do not meet anteriorly. In addition, a third specimen from Glen, Nebraska, purported by Swenk to be intermediate between *flavescens* and *olivaceogriseus,* has been examined and found to be an immature *fasciatus.*



FIGS. 2-7. Skulls of two species of pocket mice. All × 1½. In comparison with *P. flavescens* note that *P. fasciatus* has the tympanic bullae separated anteriorly and that the skull is slightly larger in over-all dimensions.

FIGS. 2-4. *Perognathus fasciatus fasciatus.* Buford, Williams County, North Dakota, May 6, 1910, ♂, No. 168599 USBS.

FIGS. 5-7. *Perognathus flavescens flavescens,* Kennedy, Cherry County, Nebraska, July 9, 1935, ♀, No. 66883 MVZ.

In the original description Swenk indicated the type locality as Chadron, Dawes County, Nebraska. The locality given on the specimen label of the holotype, however, is 5 mi. E Chadron. In addition, Swenk (*loc. cit.*), in the paragraph preceding the descrip-

tion of *olivaceogriseus*, states that the holotype was actually taken on Little Bordeaux Creek, sec. 14, T. 33 N, R. 48 W, 3 mi. E Chadron, on the farm of L. M. Gates, who obtained the holotype. It seems best to restrict the type locality to the place last mentioned.

Four specimens from southeastern Alberta recently reported by Moore (1953:143) have been examined and seem best referred, among known subspecies of *fasciatus*, to *P. f. olivaceogriseus*. They differ from the latter in several minor cranial features and more drab back, sides and lateral line. When adequate material is available they may prove to be subspecifically different from *olivaceogriseus*. Moore referred these specimens to *P. f. fasciatus*.

Specimens from extreme northwestern Nebraska, including the holotype, are slightly darker than specimens from eastern Wyoming. A specimen from Ft. Steele, Wyoming, shows approach to *P. f. litus* in pale dorsal coloration.

Specimens examined.—Total number, 59, as follows: Alberta: Foremost, 2 (UADZ). Manyberries, 1 (Alberta Dept. Pub. Health). Medicine Hat, 1 (Alberta Dept. Pub. Health). Montana: *Carter County:* Little Missouri River, 8 mi. NE Albion, 1 (USBS). *Custer County:* Calf Creek, 2 (AMNH); 13 mi. E Miles City, 1 (MZ). *Garfield County:* Piney Buttes, 1 (USBS). *Powder River County:* Powderville, 2 (USBS). *Yellowstone County:* Lake Basin, 1 (USBS). *County undesignated:* Wolf's Creek, 1 (AMNH). Nebraska: *Cherry County:* 10 mi. E Gordon, 1 (CNHM); 12 mi. ESE Gordon, 2 (CNHM). *Dawes County:* Chadron State Park, 1 (NGFPC); 1 mi. SW Chadron, 1 (NSM); Little Bordeaux Creek, 3 mi. E Chadron, 1 (MVZ); 10 mi. S Chadron, 3 (MZ); 3 mi. SW Crawford, 1 (KU). *Sheridan County:* Mirage Township, 1 (MZ). *Sioux County:* Glen, 1 (NSM); Monroe Canyon, 1 (NGFPC). South Dakota: *Custer County:* Cheyenne River, 1 (AMNH); Elk Mountain, 4800 ft., 4 (USBS). *Meade County:* Smithville, 1 (USBS). *Shannon County:* Corral Draw, 3 (AMNH); Pine Ridge, 3 (CNHM 1, USBS 2). *Washabaugh County:* White River flood plain, 7 mi. S Kadoka, 1 (MZ). Wyoming: *Campbell County:* 1¼ mi. N, ½ mi. E Rockypoint, 3850 ft., 1 (KU). *Carbon County:* Ft. Steele, 1 (USBS). *Fremont County:* 40 mi. E Dubois, 1 (MZ). *Hot Springs County:* Kirby Creek, 5000 ft., 1 (USBS). *Johnson County:* 6½ mi. W, 2 mi. S Buffalo, 5620 ft., 4 (KU); 1 mi. WSW Kaycee, 4700 ft., 1 (KU). *Natrona County:* Casper, 1 (USBS); 1 mi. NE Casper, 5150 ft., 1 (KU). *Platte County:* 2½ mi. S Chugwater, 1 (KU). *Sheridan County:* Arvada, 2 (USBS); 5 mi. NE Clearmont, 3900 ft., 1 (KU). *Weston County:* Newcastle, 1 (USBS); 23 mi. SW Newcastle, 4500 ft., 4 (KU).

Perognathus fasciatus infraluteus Thomas

Perognathus infraluteus Thomas, Ann. Mag. Nat. Hist., ser. 6, 11:406, May, 1893, type from Loveland, Larimer County, Colorado.

Perognathus fasciatus infraluteus, Osgood, N. Amer. Fauna, 18:19, September 20, 1900.

Geographic distribution.—Known only from the type locality and from 7 mi. N Ramah, Colorado. Probably in other parts of northeastern Colorado (see Figure 1).

Remarks.—For comparisons with *Perognathus fasciatus olivaceogriseus* Swenk, geographically adjacent to the north, see the preceding account of that subspecies on page 520.

Of the seven topotypes available to me, six show various degrees of encroachment of the color of the lateral line upon the underparts, giving the ventral surface a buffy appearance, the "distinguishing character" of the subspecies according to Osgood (*op. cit.*:20). When additional specimens are available, this character may be found to be one of individual variation, although no specimens from other parts of the range of the species have been found to exhibit it. Of the subspecies *P. f. infraluteus*, each of the eight specimens examined by me possesses buffy subauricular patches.

The specimen from 7 mi. N Ramah, Colorado, is slightly darker and less drab than the topotypes and does not possess buffy underparts. The skull of the specimen is broken but on the basis of characters of the pelage it seems to be intermediate between *infraluteus* and *olivaceogriseus* and is referred to the former on geographic grounds.

Specimens examined.—Total number, 8, as follows: COLORADO: *Elbert County:* 7 mi. N Ramah, 1 (MZ). *Larimer County:* Loveland, 7 (USBS).

Perognathus fasciatus litus Cary

Perognathus fasciatus litus Cary, Proc. Biol. Soc. Wash., 24:61, March 22, 1911, type from Sun, Sweetwater Valley, Natrona County, Wyoming.

Geographic distribution.—Lower Sweetwater Valley and adjacent parts of Red Desert in Carbon, Fremont, Natrona and Sweetwater counties, Wyoming (see Figure 1).

Remarks.—For comparisons with *Perognathus fasciatus olivaceogriseus*, geographically adjacent to the northeast, see account of that subspecies. From *Perognathus fasciatus callistus*, geographically adjacent to the southwest, *P. f. litus* differs in: Upper parts paler with no trace of olivaceous; hind foot shorter; skull, when specimens of equal age are compared, averaging smaller in all measurements taken (especially occipitonasal length, mastoidal breadth, length of tympanic bulla and cranial depth), except interparietal breadth which is more.

No fully adult specimens of *P. f. litus* have been available to me for this study. Two of the three specimens mentioned by Cary in the original description (holotype not seen) have been examined and found to possess adult pelage, but cranially they must be classed as young adults. These specimens are paler than those of any other subspecies of *fasciatus* and do not have the olivaceous dorsal coloration present in other subspecies.

P. f. litus is seemingly an endemic race in the lower Sweetwater Valley and adjacent parts of the Red Desert, Wyoming. The type locality, recorded by Cary in the original description as "Sun, Sweetwater Valley, Wyoming," is here placed in Natrona County on the

basis of the map (frontispiece) in Cary's (1917) "Life Zone Investigations in Wyoming."

Specimens examined.—Total number, 9, as follows: Wyoming: *Carbon County:* 8 mi. SE Lost Soldier, 6700 ft., 1 (USBS). *Fremont County:* Granite Mts., 1 (MZ). *Natrona County:* 5 mi. W Independence Rock, 6000 ft., 4 (KU); Sun, 1 (USBS); 16 mi. S, 11 mi. W Waltman, 6950 ft., 1 (KU). *Sweetwater County:* 27 mi. N Table Rock, 1 (MZ).

Perognathus fasciatus callistus Osgood

Perognathus callistus Osgood, N. Amer. Fauna, 18:28, September 20, 1900, type from Kinney Ranch, near Bitter Creek, Sweetwater County, Wyoming.

Geographic distribution.—East of the Green River in central and southern parts of Sweetwater County, Wyoming, and adjacent parts of Moffat County, Colorado (see Figure 1).

Remarks.—For comparisons with *Perognathus fasciatus litus,* geographically adjacent to the north, see account of that subspecies.

When Osgood (*loc. cit.*) described *P. f. callistus* as a full species, he characterized it as having ". . . the attractive coloration of *fasciatus,* but softer and more delicate. Its position is evidently between *fasciatus* and *apache,* and its nearest relations are clearly with the latter." He further remarked that, "Its large size immediately separates it from *fasciatus* which it resembles externally, especially before maturity."

Comparison of the average and extreme external measurements of ten adult *P. f. callistus* from Sweetwater County, Wyoming, with adult individuals of other subspecies of *P. fasciatus* shows that *callistus* does not average larger than *P. f. olivaceogriseus* except in length of hind foot and that it averages slightly smaller in all external measurements than topotypes of *P. f. fasciatus.* Moreover, judging from the accounts of Goldman (1918:24) and Durrant (1952:235), *Perognathus apache caryi* (the subspecies of *P. apache* nearest to the range of *P. f. callistus*) is significantly larger externally and has no trace of olivaceous in the dorsal pelage.

Comparison of the skulls of *callistus* with a skull of *Perognathus apache apache* from Wingate, New Mexico (USBS 137388), reveals the following differences: Interparietal bone wider in *callistus;* averaging 4.5 (as opposed to 4.0) and more pentagonal; lacrimal bone shorter and stouter in *callistus;* tympanic bullae more inflated in *callistus;* interorbital foramina larger in *callistus;* lower premolar approximately the same size as the last lower molar in *callistus,* approximately half the size of the last lower molar in *apache.* Conversely, comparison of skulls of *callistus* with those of *P. fasciatus* as concerns the above mentioned features reveals that they closely resemble each other. In view of this resemblance it seems best to arrange *callistus* as a subspecies of *P. fasciatus.*

P. f. callistus is distinct cranially from all other subspecies of *P. fasciatus* in the narrowness of the interparietal, the greater length of the tympanic bulla and the greater mastoidal breadth. The fine, silky nature of the pelage is shared, to some extent, with *P. f. litus*.

A specimen from 27 mi. N, 37 mi. E Rock Springs, Wyoming, referred to *callistus* resembles *litus* in pale dorsal coloration and slightly wider interparietal. Four immature specimens from 25 mi. N, 38 mi. E Rock Springs, also referred to *callistus*, have extremely pale juvenal pelage and also are judged to be intergrades with *litus*.

Specimens examined.—Total number, 23, as follows: WYOMING: *Sweetwater County:* 18 mi. S Bitter Creek, 6800 ft., 3 (KU); Kinney Ranch, 21 mi. S Bitter Creek, 6800 ft., 9 (KU 7, USBS 2); 30 mi. S Bitter Creek, 2 (KU); 33 mi. S Bitter Creek, 6900 ft., 2 (KU); 32 mi. S, 22 mi. E Rock Springs, 7025 ft., 2 (KU); 25 mi. N, 38 mi. E Rock Springs, 6700 ft., 4 (KU); 27 mi. N, 37 mi. E Rock Springs, 6700 ft., 1 (KU).

TABLE 1.—CRANIAL MEASUREMENTS OF PEROGNATHUS FASCIATUS

Sex and number of individuals averaged or catalog number	Occipitonasal length	Frontonasal length	Basal length*	Mastoidal breadth	Interorbital breadth	Interparietal breadth	Cranial depth	Length of tym. bulla	Length of maxillary tooth-row
	P. f. fasciatus, topotypes								
6, 4 ♂ and 2 ♀	23.3[5]	15.5[5]	18.4	12.3	5.3	4.9	8.7	7.3	3.3
min.	22.9	14.9	17.8	12.1	5.1	4.8	8.6	7.0	3.2
max.	24.2	16.5	18.9	12.8	5.5	5.1	9.1	7.6	3.4
	P. f. olivaceogriseus, holotype								
♂ 97941 MVZ	22.1	14.5	17.4	12.0	5.2	4.6	8.3	7.3	3.5
	Various localities in eastern Wyoming								
6, 5 ♂ and 1 ♀	22.8	15.0	18.0	12.4[5]	5.0	4.9	8.4[5]	7.3	3.3
min.	22.2	14.5	17.5	12.2	4.9	4.7	8.1	7.1	3.3
max.	23.7	15.7	18.6	13.0	5.1	5.2	8.6	7.6	3.5
	P. f. infraluteus, topotypes								
4, 3 ♂ and 1 ♀	21.9	14.4	17.3	12.2	4.9	5.2	8.2	6.9	3.4
min.	21.4	14.0	17.1	11.8	4.9	4.9	8.0	6.7	3.3
max.	22.4	14.9	17.4	12.6	5.0	5.4	8.5	7.1	3.5
	P. f. litus, topotype								
♀ 160599 USBS	22.2	14.7	17.4	11.9	5.0	5.0	8.7	7.0	3.3
	8 mi. SE Lost Soldier, 6700 ft., Wyoming								
♀ 166866 USBS	22.1	14.6	17.4	12.0	5.2	4.5	8.4	7.1	3.3
	P. f. callistus, Sweetwater County, Wyoming								
10, 6 ♂ and 4 ♀	23.1	15.1	18.0[8]	12.9[8]	5.2	4.5	8.7	7.6	3.
min.	22.7	14.7	17.5	12.7	5.0	4.1	8.5	7.3	3.3
max.	24.4	15.9	18.9	13.1	5.4	4.9	8.9	7.8	3.5

* Basal length was taken from the anteriormost inferior border of the foramen magnum to the anteriormost projections of the incisors.

LITERATURE CITED

Cary, M.
1911. A new pocket mouse from Wyoming. Proc. Biol. Soc. Washington, 24:61, March 22.
1917. Life Zone investigations in Wyoming. N. Amer. Fauna, 42:1-95, October 3.

Durrant, S. D.
1952. Mammals of Utah, taxonomy and distribution. Univ. Kansas Publ., Mus. Nat. Hist., 6:1-549, August 10.

Goldman, E. A.
1918. Five new mammals from Arizona and Colorado. Proc. Biol. Soc. Washington, 31:21-26, May 16.

Moore, J. E.
1953. Notes on three additions to the rodent fauna of Alberta. Canadian Field Nat., 66:142-143, February 28.

Osgood, W. H.
1900. Revision of the pocket mice of the genus *Perognathus*. N. Amer. Fauna, 18:1-72, September 20.

Swenk, M. H.
1940. A study of the geographical and ecological distribution of the buffy plains pocket mouse (Perognathus flavescens flavescens), with description of a new subspecies from Nebraska. Missouri Valley Fauna, 3:1-8, June 5.

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A New Subspecies of Wood Rat (Neotoma mexicana) From Colorado

BY

ROBERT B. FINLEY, JR.

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A New Subspecies of Wood Rat (Neotoma mexicana) from Colorado

By

ROBERT B. FINLEY, JR.

Field and museum studies of the wood rats of Colorado have revealed the existence of an unnamed subspecies of *Neotoma mexicana* in eastern Colorado south of the Arkansas River. The characters of the new subspecies are most distinctive in the northeastern part of its range near Two Buttes and Higbee. It differs in cranial characters from *N. m. fallax* and *N. m. inopinata* and averages slightly larger, but cannot be distinguished by coloration of the pelage.

This heretofore undescribed subspecies may be known as:

Neotoma mexicana scopulorum subsp. nov.

Type.—Mus. Nat. Hist., Univ. Kansas, No. 37137, old adult male, skin and skull; from 37° 47′ N, 103° 28′ W, three miles northwest of Higbee, 4300 feet, Otero County, Colorado; trapped 16 May 1950 by R. B. Finley, Jr., original number 500516-1.

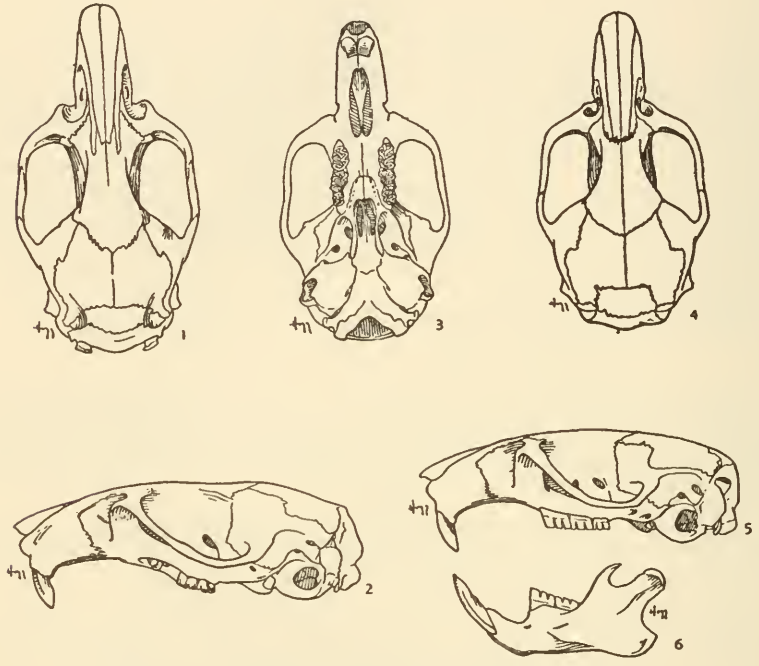
Range.—Cañons, mesas, and foothills south of the Arkansas River, east to Two Buttes, Colorado, and south to Clayton, New Mexico. The extent of the range to the southwest in New Mexico has not been determined.

Diagnosis.—Size large for the species; interorbital constriction near middle of frontal rather than anteriorly; supraorbital ridges of frontal concave laterally; skull large, strongly arched at base of rostrum; rostrum wide; nasals wide anteriorly; upper incisors wide, light yellow; molars large, tooth-rows long; zygomatic arches wide and heavy; interparietal short, wide, and posterior margin straight or with a slight posterior median angle.

Description.—Adults in dense unworn pelage taken in February at Two Buttes Reservoir: size large for the species; tail approximately 76 per cent as long as head and body; hind feet of medium length. Pelage: moderately long, thick; tail covered with short hairs; longest vibrissae 80 mm. Color: sides near Raffia (11 E 6) (capitalized color names and designators are of Maerz and Paul, A Dictionary of Color, McGraw-Hill Book Co., New York, 1930) overlaid with black, the general effect being grayish buff (13 G 6); back darker, moderately to heavily overlaid with black; indistinct dark eye ring; underparts whitish, fur basally gray except patch of fur pure white to base almost always present on upper throat; dark line around mouth; tail bicolor, black above, whitish below; feet white to ankles.

Skull: large for the species, strongly arched at base of rostrum; rostrum heavy; zygomatic arches widely spreading, heavy, squarish; braincase moderately ridged and angular; nasals wide anteriorly, lateral margins nearly parallel or converging evenly posteriorly, tapered abruptly at posterior ends which

reach posteriorly beyond anterior plane of orbits; dorsal branches of premaxillae extending 0.5 to 1.2 mm. posterior to nasals; interorbital region moderately channeled, narrowly constricted near middle of frontal (instead of anteriorly); supraorbital ridges concave laterally, diverging more strongly posterior to interorbital constriction (frontal 8.7 to 9.5 mm. wide at posterior ends of supra-



Figs. 1-6. Skulls of *Neotoma mexicana*. All × 1.
Figs. 1-2. *Neotoma mexicana scopulorum*, holotype.
Figs. 3-6. *Neotoma mexicana fallax*, 1½ mi. NW Golden, 6200 ft., Jefferson County, Colorado, 8 June 1948, ♂ No. 29182 KU.

orbital ridges); temporal ridges widely flaring on parietals; occipital ridges prominent; interparietal broadly rectangular between temporal ridges, usually short in median line of skull, posterior margin straight or with slight median posterior angle; incisive foramina tapered toward both ends, sometimes narrower anteriorly than posteriorly; anterior palatal spine usually forming a blade thickened on ventral edge, and right and left sides usually incompletely fused; nasal septum with a posterior notch separating vomer from maxillary; posterior margin of palate usually bearing single or double point, sometimes straight; interpterygoid fossa moderately wide, lateral margins concave; sphenopalatine vacuities large; auditory bullae of medium size; basioccipital with low median ridge or crest; upper incisors wide, yellow or yellow-orange; molars large, M1 wider than M2; maxillary tooth-rows long, nearly parallel; anterointernal fold of M1 deep, cutting more than half way across first enamel loop.

Adult in worn pelage taken in May at Two Buttes peak: no molt in evidence; pelage thinner and rougher than in adults of same tooth wear taken in Febru-

ary in unworn pelage (described above); upper parts duller, less heavily overlaid with black; sides less richly yellowish, slightly more pinkish in hue; underparts with no fur white to base (as usual for the species). The skull of this rat has narrower nasals than other adults from Two Buttes and a longer interparietal with a posterior median angle.

Subadult taken in April at Regnier: completing postjuvenal (first) molt; new pelage fairly long and thick everywhere except on neck and upper back, where covered by remaining juvenal pelage; upper parts of new pelage duller than in adults, sides less buffy, more grayish; juvenal pelage grayer than new pelage; new pelage indistinguishable from same pelage (second pelage of first year) of *N. m. fallax*.

Comparisons.—*N. m. scopulorum* is extremely variable in color but averages lighter and richer in color than *N. m. fallax*, and about the same as *N. m. inopinata*. *N. m. scopulorum* can be separated from either by the following cranial differences: skull larger, more strongly arched at base of rostrum, interorbital constriction more posterior; supraorbital ridges concave laterally (in contrast to straight, diverging); interparietal shorter in median line, more widely spreading and rectangular; zygomatic arches more widely spreading and heavier; upper incisors wider; and molars larger. *N. m. scopulorum* differs from *inopinata* also in paler upper incisors and less prominent basicranial ridges.

N. m. scopulorum is paler than *N. m. pinetorum*. The skulls of these two subspecies are of about the same size, but the subspecies differ in other respects as *scopulorum* differs from *fallax* and *inopinata*.

Judging from the description and photograph of *mexicana* in Goldman's revision of the genus *Neotoma* (N. Amer. Fauna, 31: 54-56, Pl. IV, 19 October 1910), *scopulorum* differs from *N. m. mexicana* in: larger skull; longer nasals and dorsal branches of premaxillae; more posterior interorbital constriction (supraorbital ridges more concave laterally); wider upper incisors; and larger molars.

Measurements.—Mean and extreme measurements in millimeters of 6 males and 5 females from 3 mi. NW Higbee and the vicinity of Two Buttes are, respectively, as follows: total length, 357 (345-368), 345 (310-379); length of tail, 147 (140-158), 159 (138-178); length of hind foot, 35 (32-38), 36.4 (35-38); length of ear, from notch, 25.5 (25-26), 25.7 (25-27); weight (in grams), 234 (213-253), 206 (161-246); basilar length, 37.9 (36.8-38.9), 36.2 (34.5-38.6); length of nasals, 19.0 (18.2-20.0), 17.9 (16.4-19.6); zygomatic breadth, 23.9 (23.0-24.5), 23.3 (22.3-24.0); interorbital breadth, 5.3 (4.9-5.6), 5.1 (5.0-5.3); breadth of rostrum, 7.2 (6.8-7.7), 6.8 (6.7-6.9); diastema, 12.8 (12.3-13.3), 12.2 (11.1-13.7); alveolar length of maxillary tooth-row, 9.5 (9.2-9.8), 9.4 (9.0-9.7); length of incisive foramina, 9.7 (9.2-10.2), 9.2 (8.6-10.2); length of palatal bridge, 8.8 (8.4-9.2), 8.5 (8.0-8.9).

Measurements of the type.—Total length, 348; length of tail, 143; length of hind foot, 35; length of ear, from notch, 25; weight (in grams), 230; basilar length, 38.1; length of nasals, 18.8; zygomatic breadth, 24.2; interorbital constriction, 5.5; breadth of rostrum, 7.2; diastema, 13.0; alveolar length of maxillary tooth-row, 9.2; length of incisive foramina, 9.7; length of palatal bridge, 8.9.

Remarks.—The large size and distinctive cranial characters of *N. m. scopulorum* are fairly constant in the northeastern part of its range, but there is a wide range of variation in color. The only two skins from the type locality differ

markedly in color. Both specimens (the type and KU 37138, adult male) were collected on 16 May 1950 and are in moderately worn pelage. The upper parts of the holotype are much more yellowish than in KU 37138, and are even lighter buff than adults in unworn pelage from Two Buttes. The underparts of the holotype are more extensively white than in almost any other specimen seen of *Neotoma mexicana*. The basal gray coloration, where it is present along the sides of the venter, forms only a narrow intermediate color band extending not more than one third the length of the hairs. An extensive area of the throat, breast, axillae, median belly, and inguinal region is covered by hairs pure white to the skin. The dark line around the mouth is present, as usual for the species. The upper parts of KU 37138 are like those of the adult in worn pelage from Two Buttes peak, described above; the underparts have only small patches of pure white fur on the throat and inguinal region, being elsewhere gray at the base of the fur, as is usual for the species.

The molars of the type specimen are in an advanced state of wear, having the pattern of the enamel folds still discernible but the depth of remaining enamel slight. A large alveolar abscess surrounds the abnormal left M1. There are two, much worn, peglike fragments of the tooth projecting slightly from an ovoid alveolar cavity 5.1 mm. long and 4.3 mm. wide. As a result of the reduction of wear on the opposing m1, the crown of m1 is much less worn than those of the other lower molars and projects 0.8 mm. above the occlusal level of the two posterior molars. A few barbed cactus glochids (bristles) are inbedded in the cavity around the base of the molar remnants. Although glochids are of rather frequent and normal occurrence between the teeth of *Neotoma albigula* and *N. micropus*, they are not so commonly found in *N. mexicana* and possibly induced the alveolar infection in this individual.

In addition to the skins in unworn and worn pelages already described from Two Buttes, an extremely dark specimen is at hand from Two Buttes peak, taken on 9 May 1950. This specimen (KU 37141 ♀) is an adult in moderately worn pelage. The back is dark brownish gray (Taupe, 16 A 6), the sides lighter (a shade lighter than Beaver, 15 A 6). The entire underparts are washed with reddish buff (Grain, 11 B 5) over the gray basal coloration, with a patch of white only in the genital region. The dark eye ring and dark line around the mouth are heavier than usual. The underside of the tail is light gray. The white hind feet are sharply set off from the dark gray ankles.

Each of four skulls from Regnier (three adults and one subadult) differs from skulls from Two Buttes in having a longer interparietal with a posterior angle. The skins of five adults collected in December at Trinchera are less richly colored on the sides than skins from Two Buttes and look more nearly like topotypes of *N. m. fallax*. The skull of one of the five from Trinchera differs from skulls from Two Buttes in much narrower nasals anteriorly, narrower rostrum, much narrower upper incisors, and smaller zygomatic breadth, these characters being as in *fallax*.

Four adults and one subadult from Trinidad are intergrades between *N. m. scopulorum* and *N. m. fallax*, perhaps more nearly resembling the former. In pelage they are indistinguishable from specimens of *fallax* from Gold Hill (the type locality), less buff than most individuals of *scopulorum* from Otero, Prowers, and Baca counties. The skulls of the three fully mature adults are large with a wide zygomatic breadth, large rostrum, and large upper incisors

as in *scopulorum;* but the upper molars are small and the bullae are rather small and narrow as in *fallax.* In the degree of arching at the base of the rostrum, the shape of the frontal, the shape of the interparietal, and the size of the upper molars, the specimens from Trinidad are intermediate. It seems to me best to refer them to *scopulorum.*

Two first-year adults from Fisher Peak and Long Cañon are indistinguishable from topotypes of *fallax* of similar age and also resemble a young adult and a subadult from Trinidad, but all are insufficiently mature to show subspecific characters distinctly. Until adequate series are available from southwestern Las Animas County it seems best to regard all specimens from the three localities as representatives of a single uniform population which is intermediate between *fallax* and *scopulorum* but more nearly like the latter. Unfortunately no other specimens are available from the foothill zone south of the Arkansas River where morphological intergradation and ecological transition between *fallax* and *scopulorum* might reasonably be expected to occur.

Three specimens from the north side of the Arkansas River, about 26 miles below Canon City, Pueblo County, are like *fallax* in size, dorsal profile of the skull, and shape of the interorbital constriction; but they approach *scopulorum* in shape of the interparietal, size of the rostrum, and size of the molars. They are intergrades referrable to *fallax.*

Neotoma mexicana was first reported from Oklahoma by W. Frank Blair in 1939 (Amer. Midl. Nat., 22:126) who referred a specimen from Tesequite Canyon, Cimarron County, to *N. m. fallax.* I have seen one specimen (MZ 80469) from Tesequite Canyon and refer it to *scopulorum.*

Of *scopulorum,* each of eight skulls, of the 28 skulls examined, has an anteroexternal enamel fold on the m3 and one (BSC 35222/47487 ♂) has an anterointernal fold on the m3. Of the other 19 mandibles, a few are too old to show such a fold, which tends to be obliterated with wear in later age, and the others lack the fold.

Two other wood rats (*N. albigula warreni* and *N. micropus canescens*) occur at many of the same localities as *N. m. scopulorum.* The dens of *scopulorum* almost always are situated among rocks, but the dens of *warreni* and *canescens* are in a variety of other situations as well as among rocks. Houses of sticks or cactus joints piled up around the base of a juniper (*Juniperus monosperma*), thicket of skunkbush (*Rhus trilobata*), clump of soapweed (*Yucca glauca*) or tree cactus (*Opuntia arborescens*) have been found to shelter only *N. a. warreni* or *N. micropus canescens.* When these wood rats are associated with *scopulorum* among the rocks, their dens can be recognized by the compact midden of innumerable cactus spines. The dens of *scopulorum* have only a few loosely scattered spine areoles or none at all.

I am grateful to the officials of the following institutions for permission to examine specimens from the collections under their care: Denver Museum of Natural History; Biological Survey Collection, U. S. Fish and Wildlife Service; American Museum of Natural History; Museum of Vertebrate Zoology, University of California; Museum of Zoology, University of Michigan. The drawings of the skulls were made by Victor Hogg.

Specimens examined.—Total 66, distributed as follows:

Colorado. *Baca County:* "Furnace Canyon" [= Furnish Canyon], 1 (DMNH); Regnier, 4500 ± ft., 4 (2 DMNH, 2 KU); Two Buttes Reservoir,

4200 ± ft., 5 (3 DMNH, 2 KU). *Las Animas County:* Fisher Peak, "about 8000 ft." [6 mi. SE Trinidad], 1 (BSC); Long Cañon (near Martinsen), 1 (BSC); Mesa de Maya, 1 (MZ); 9 mi. W jct. Purgatory [= Purgatoire] & Chaquaqua [= Chacuaco] rivers ("Red Rock Canyon," collector's field notes), 1 (MVZ); Trinchera, 6 (5 DMNH, 1 AMNH); Trinidad, 5 (BSC); 20 mi. E Walsenburg, "Huerfano Co." [probably Las Animas County], 1 (DMNH). *Otero County:* 3 mi. NW Higbee, 4300 ft., 4 (KU). *Prowers County:* Two Buttes peak, 4600 & 4650 ft., 2 (KU).

New Mexico. *Union County:* Clayton, 9 (BSC); 9 mi. NE Des Moines on the "Carramba River" [= Cimarron River], 1 (DMNH); Folsom, 6 (BSC); Raton Range (Oak Cañon), 8 (BSC); Sierra Grande, 9 (BSC).

Oklahoma. *Cimarron County:* Tesequite Canyon, 1 (MZ).

Museum of Natural History, University of Kansas, Lawrence. Transmitted April 20, 1953.

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24-7674

Four New Pocket Gophers of the Genus Cratogeomys from Jalisco, Mexico

BY

ROBERT J. RUSSELL

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Four New Pocket Gophers of the Genus Cratogeomys from Jalisco, Mexico

By

ROBERT J. RUSSELL

In the course of my taxonomic study of the genus *Cratogeomys,* a high degree of variation was found between several populations of these gophers in central Jalisco. Two species, *C. gymnurus* and *C. zinseri,* occur in this part of the state. Previously *C. gymnurus* was known only from southern Jalisco and *C. zinseri* only from extreme eastern Jalisco, but through the efforts of J. R. Alcorn specimens were obtained of both species in the central part of the state. These large gophers are difficult to collect, and I am grateful to him for securing this significant material. Costs of the field work were defrayed by the National Science Foundation and the Kansas University Endowment Association. Thanks are due also to those in charge of the United States Biological Surveys Collection for the loan of comparative material. Study of the recently acquired specimens taken in central Jalisco reveals two undescribed subspecies each of *C. gymnurus* and *C. zinseri.* These may be known and described as

Cratogeomys gymnurus tellus new subspecies

Type.—Female, adult, skull and skin, No. 33454 Mus. Nat. Hist., Univ. Kansas; from 3 mi. W Tala, 4300 ft., Jalisco, México; obtained on June 2, 1949, by J. R. Alcorn, original No. 9376.

Range.—North-central Jalisco; known from several localities in the vicinity of Tala.

Diagnosis.—Size large (see measurements); tail long, naked; hind foot small; color pale for species, upper parts Kaiser Brown (capitalized terms are of Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912), bases of individual hairs Plumbeous, tips Hazel, underparts creamy-white, bases of hairs Plumbeous; skull large, relatively narrow, rugose; zygomatic breadth narrower posteriorly than anteriorly; rostrum shallow, relatively broad in males, narrower in females; interorbital region broad; braincase narrow and flattened; basioccipital relatively wide, especially anteriorly; mastoid processes of squamosal large, knoblike; paroccipital processes long, extending laterally over more than half the width of mastoid bullae; upper incisors projecting anteriorly; maxillary teeth relatively large.

Comparisons.—From topotypes of *C. g. gymnurus* from Zapotlan, Jalisco, the most closely related subspecies, *C. g. tellus* differs in: Body smaller (total length averaging 338 instead of 341 in females and 356 instead of 369 in

males); hind foot smaller (averaging 45 instead of 50 in females and 47 instead of 51 in males); color more brownish above, creamy-white rather than buffy below; skull smaller, especially in females (basilar length averaging 55.3 instead of 57.5 in females and 57.7 instead of 60.5 in males), narrower, and more rugose; zygomatic breadth less in females (averaging 42.5 compared with 46.2), greater in males (48.0 compared with 46.7); zygomata more nearly parallel; auditory bullae relatively smaller; mastoid processes of squamosal larger, knoblike; paroccipital processes longer, extending farther laterally; rostrum less massive; upper incisors projecting anteriorly, instead of being strongly recurved; maxillary teeth relatively larger.

From near-topotypes of *C. g. inclarus* from the Sierra Nevada de Colima, Jalisco, *C. g. tellus* differs in: Hind foot smaller; color paler brownish above in contrast to glossy black, creamy-white below rather than buffy, feet clothed with whitish instead of brownish hairs; skull larger (basilar length averaging 55.3 in females compared with 53.2, no males available for comparisons); zygomatic breadth less; nasals longer, extending posterior to front edge of anterior roots of zygomata rather than ending even with, or slightly behind, them; rostrum more massive; mastoid processes of squamosal larger; paroccipital processes extending farther laterally; upper incisors projecting anteriorly, rather than recurved; maxillary teeth larger (length of maxillary tooth-row averaging 14.6 compared with 13.3).

Close comparison with *C. g. imparilis* from Pátzcuaro, Michoacán, is not needed, but *C. g. tellus* differs especially in: Color of underparts and hairs of feet whitish rather than brownish; skull smaller; zygomatic breadth greater; interorbital constriction broader; nasals longer; maxillary tooth-row longer.

Measurements.—Averages of three adult females, including type, and the measurements of an adult male (in parentheses) from the type locality are: Total length, 338 (356); length of tail, 92 (87); length of hind foot, 45 (47); occipitonasal length of skull, 64.1 (68.7); basilar length, 55.3 (61.4); zygomatic breadth, 42.7 (48.0); interorbital breadth, 9.6 (11.4); greatest height of cranium, taken from palate perpendicular to line touching two highest points on top of skull, 23.9 (25.3); least depth of rostrum, 10.6 (11.7); breadth of rostrum, 14.7 (16.5); length of nasals, 23.6 (25.2); width across mastoid processes of squamosal, 43.8 (49.7); height of occiput, 18.1 (19.9); length of maxillary tooth-row, 14.6 (15.2).

Remarks.—The distribution of *C. gymnurus* is spotty; its occurrence seemingly depends on edaphic conditions. The isolation of soils with textures suitable to this animal has resulted in the isolation of gopher populations. The distribution is similar to that of species occurring on islands. In this instance, however, the populations of gophers are separated by soils of heavy texture which render burrowing difficult or impossible for gophers. Such conditions have lead to a high degree of subspeciation in a relatively short distance. For example, four subspecies of *C. gymnurus* occur in Jalisco, and, all are within an area scarcely fifty miles in diameter.

Cratogeomys gymnurus tellus is the northernmost subspecies of *C. gymnurus*. It is known from only the vicinity of Tala, west of Guadalajara, and its range probably is not much more extensive than this because of the localized distribution of suitable soils.

Specimens examined.—Total number ten, as follows: 3 mi. W Tala, type locality, 5; 1 mi. NE Tala, 3; 1 mi. S El Refugio, 2.

Cratogeomys gymnurus atratus new subspecies

Type.—Female, adult, skull and skin, No. 31880 Mus. Nat. Hist., Univ. Kansas; from Top of Cerro Viejo de Cuyutlán, 9700 ft., 19 mi. S and 9 mi. W Guadalajara, Jalisco, México; obtained on February 17, 1949, by J. R. Alcorn, original No. 7902.

Range.—Known only from the type locality on the Cerro Viejo.

Diagnosis.—Size small (see measurements); tail long; hind foot small; color dark, upper parts glossy Blackish Brown, bases of hairs Plumbeous, sides Chestnut Brown, underparts Pale Ochraceous-Buff or Warm Buff mixed with Plumbeous of the hair bases; skull small, lightly constructed, relatively deep; zygomata relatively weak; zygomatic breadth wider posteriorly than anteriorly; rostrum relatively wide, especially in males; nasals relatively long, truncate posteriorly; interorbital constriction narrow; braincase inflated; mastoid processes of squamosal only slightly wider than zygomatic breadth; auditory bullae relatively large; paroccipital processes weakly constructed, but extend laterally over half the width of mastoid bullae; upper incisors projecting anteriorly, rather than being strongly recurved; maxillary teeth small.

Comparisons.—From topotypes of *C. g. gymnurus* from Zapotlan, Jalisco, *C. g. atratus* differs in: Body smaller (total length averaging 300 in females compared with 341, a male measured 315 compared with an average of 363); tail shorter, hind foot smaller; color of upper parts darker, glossy Blackish-Brown rather than reddish brown, underparts paler; skull smaller (basilar length averaging 48.6 compared with 57.5, a male measured 50.0 compared with an average of 59.0); zygomata more weakly constructed; zygomatic breadth less, and wider posteriorly than anteriorly; braincase more inflated; nasals shorter; rostrum relatively narrower and shallower; width across mastoid processes of squamosals less; paroccipital processes less strongly constructed, extending farther laterally; upper incisors projecting anteriorly rather than being strongly recurved; maxillary teeth smaller (length of maxillary tooth-row averaging 11.2 compared with 14.9).

From *C. g. tellus,* that occurs to the northwest, *C. g. atratus* differs in: Body smaller; hind foot slightly smaller; upper parts darker; underparts Pale Ochraceous-Buff rather than creamy-white; skull smaller (see measurements); zygomatic breadth less, and wider posteriorly than anteriorly; nasals shorter, truncate posteriorly rather than emarginate; rostrum narrower and shallower; maxillary teeth smaller.

From near-topotypes of *C. g. inclarus* from the Sierra Nevada de Colima, *C. g. atratus* differs in: Body slightly smaller; hind foot smaller (averaging 42 compared with 49); color of upper parts near the same, underparts paler; skull smaller, narrower, weaker in construction; zygomatic breadth less; nasals relatively longer, but actually shorter (averaging 19.7 compared with 20.3); upper incisors projecting anteriorly rather than being recurved; maxillary teeth smaller.

Measurements.—The type and an adult female (its measurements in parentheses) yield measurements as follows: Total length, 300 (299); length of tail, 78 (83); length of hind foot, 43 (40); occipitonasal length of skull, 56.3 (55.5); basilar length, 49.3 (47.8); zygomatic breadth, 37.9 (36.5); interorbital breadth, 8.7 (8.1); greatest height of cranium, as explained above, 21.6 (20.7); least depth of rostrum, 9.2 (8.8); breadth of rostrum, 12.8 (12.7);

length of nasals, 19.4 (20.0); width across mastoid processes of squamosal, 38.2 (37.1); height of occiput, 16.9 (17.3); length of maxillary tooth-row, 11.9 (11.3).

Remarks.—*Cratogeomys gymnurus atratus* is the smallest subspecies known for the species, and is so distinct from other described subspecies, that it is difficult to select one as the closest relative. In color, *C. g. atratus* closely resembles *C. g. inclarus,* which occurs at comparable elevations in the Sierra Nevada, but the skulls are unlike. Among named subspecies of *C. gymnurus,* the skull of *tellus* most closely resembles that of *atratus,* and, although they differ greatly in size, *C. g. tellus* seems to be the closest relative of *C. g. atratus.*

This newly described subspecies is known only from Cerro Viejo and is probably restricted to the higher elevations on this mountain.

Specimens examined.—Seven, Top of Cerro Viejo de Cuyutlán, 19 mi. S and 9 mi. W Guadalajara.

Cratogeomys zinseri zodius new subspecies

Type.—Male, adult, skull and skin, No. 31879 Mus. Nat. Hist., Univ. Kansas; from 13 mi. S and 15 mi. W Guadalajara, Jalisco, México; obtained on February 6, 1949, by J. R. Alcorn, original No. 7747.

Range.—Known only from the type locality.

Diagnosis.—Size small (see measurements); tail short; hind foot small; upper parts Sayal Brown, underparts Pinkish Buff, hind foot whitish; skull small, narrow; outline of dorsal profile of skull concave; zygomatic breadth narrow; nasals actually short, but relatively long; width across mastoid processes of squamosal short; auditory bullae inflated; interorbital constriction narrow; maxillary teeth relatively large.

Comparisons.—From topotypes of *C. z. zinseri* from Lagos, Jalisco, *C. z. zodius* differs in: Body smaller (see measurements); tail shorter, hind foot smaller; upper parts dull brownish instead of reddish-brown, underparts paler, hairs of feet whitish instead of brownish; skull smaller, especially in females, narrower; dorsal profile of skull concave or flat (females) rather than convex; zygomatic breadth less; rostrum narrower and shallower; nasals actually shorter, but relatively longer in relation to length of skull; width across mastoid processes of squamosal shorter; maxillary teeth smaller.

Measurements.—The type and an adult male (his measurements in parentheses) yield measurements as follows: Total length, 318 (324); length of tail, 95 (89); length of hind foot, 41 (41); occipitonasal length of skull, 60.5 (59.1); basilar length, 52.4 (51.8); zygomatic breadth, 40.6 (39.0); interorbital breadth, 8.3 (8.8); greatest height of cranium, as explained above, 22.6 (22.4); least depth of rostrum, 11.2 (10.4); breadth of rostrum, 13.3 (13.9); length of nasals, 21.7 (21.2); width across mastoid processes of squamosal, 37.1 (36.8); height of occiput, 17.7 (17.9); length of maxillary tooth-row, 13.0 (13.3). A nearly adult female measured: Total length, 292; length of tail, 81; length of hind foot, 39; occipitonasal length of skull, 53.3; basilar length, 46.5; zygomatic breadth, 34.1; interorbital breadth, 7.8; greatest height of cranium, 21.0; least depth of rostrum, 9.8; length of nasals, 18.0; width across mastoid processes of squamosal, 32.2; depth of occiput, 15.9; length of maxillary tooth-row, 12.1.

Remarks.—This newly described subspecies is the smallest of known races of *C. zinseri,* and it is seemingly more closely related to *C. z. zinseri* than to the subspecies newly named below from the north end of Lago Sayula. The skulls of females are especially small and delicate in structure; the males are larger with more massive skulls. *C. z. zodius* is known to occur in the foot hills north of the Cerro Viejo, the mountain from which *C. g. atratus* was described above.

Specimens examined.—Seven, 13 mi. S and 15 mi. W Guadalajara.

Cratogeomys zinseri morulus new subspecies

Type.—Male, adult, skull and skin, No. 36679 Mus. Nat. Hist., Univ. Kansas; from N end Lago Sayula, 4400 ft., 9 mi. N and 2 mi. E Atoyac, Jalisco, México; obtained on March 23, 1950, by J. R. Alcorn, original No. 10889.

Range.—Known only from the type locality in central Jalisco.

Diagnosis.—Size large (see measurements); tail short; hind foot large; upper parts Fuscous-Black, strongly mixed with Walnut Brown, underparts Cinnamon-Buff, bases of all hairs Plumbeous; skull large, broad, rugose; outline of dorsal profile slightly concave, almost flat; zygomata strongly constructed, maxillary arm almost touching squamosal arm over jugal; wide across zygomata; nasals actually and relatively long; rostrum relatively narrow; auditory bullae inflated, relatively large; maxillary teeth relatively large.

Comparisons.—From topotypes of *C. z. zinseri* from Lagos, Jalisco, *C. z. morulus* differs in: Tail shorter (averaging 96 in females compared with 101, 94 in males compared with 115); color darker above, Fuscous-Black instead of Cinnamon-Rufous, underparts paler; skull larger (occipitonasal length 63.7 rather than averaging 58.5 in females and 68.6 rather than 63.1 in males); wide across zygomata; nasals actually and relatively longer; rostrum relatively narrower; wider across mastoid processes of squamosal; auditory bullae inflated, relatively larger; maxillary teeth larger.

From *C. z. zodius,* that occurs to the northeast, *C. z. morulus* differs in: Body larger (see measurements); hind foot larger; color of upper parts darker, underparts paler; skull much larger, broader, more rugose; dorsal profile of skull slightly concave rather than convex; wider across zygomata; nasals actually and relatively longer; rostrum broader, more massive; wider across mastoid processes of squamosal; auditory bullae larger; maxillary teeth larger.

Measurements.—The type and an adult female (her measurements in parentheses) from the type locality measure: Total length, 358 (338); length of tail, 94 (97); length of hind foot, 49 (45); occipitonasal length of skull, 68.6 (63.7); basilar length, 58.0 (55.6); zygomatic breadth, 49.3 (45.0); interorbital breadth, 9.6 (8.9); greatest height of cranium, as explained above, 26.1 (24.6); least depth of rostrum, 12.5 (10.8); breadth of rostrum, 14.5 (13.7); length of nasals, 25.9 (22.5); width across mastoid processes of squamosal, 47.7 (42.8); height of occiput, 19.8 (17.8); length of maxillary toothrow, 13.9 (13.8).

Remarks.—*Cratogeomys zinseri morulus* is the darkest subspecies known of *C. zinseri.* It differs widely from other subspecies of this species in color and the large size of the skull.

Cratogeomys zinseri occurs over the same general area as *C. gymnurus* in central Jalisco, although these two species seemingly do not share the same

local habitat. *C. zinseri* differs from *C. gymnurus* as follows: Tail relatively longer; skull wider across zygomatic arches than across mastoid processes of squamosal (reverse true in *C. gymnurus*); zygomata strongly bowed outward anteriorly; maxillary arm of zygomata almost touching squamosal arm (instead of widely separated from each other) above jugal; rostrum relatively narrower, less massive; border of nasals parallel or laterally swollen instead of gradually tapering.

Specimens examined.—Four, N end of Lago Sayula, 9 mi. N and 2 mi. E Atoyac.

Museum of Natural History, University of Kansas, Lawrence. Transmitted June 12, 1953.

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Genera and Subgenera of Chipmunks

BY

JOHN A. WHITE

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Introduction

The supraspecific categories of the chipmunks, as in most other groups of squirrels, have been a source of controversy for many years. Before presenting new evidence and a review of older evidence bearing on the problem, it seems desirable to review briefly in chronological order, the taxonomic history of the genera and subgenera of the chipmunks.

Historical

Linnaeus (1758:64) described the eastern North American chipmunks under the name *Sciurus striatus* and based his description on that of Catesby (1743:75). The Asiatic chipmunk was first described, under the name *Sciurus sibiricus,* by Laxmann (1769:69). Schreber (1785, 4:790) separated the Asiatic and North American chipmunks into the Asiatic and American varieties. Gmelin (1788:50) followed Schreber and, employing trinomials, used the names *Sciurus striatus asiaticus* and *S. s. americanus.* Illiger (1811:83) proposed *Tamias* as the generic name of the chipmunk of eastern North America. Say (1823:45) described *Sciurus quadrivittatus,* the first species of chipmunk known from western North America.

Trouessart (1880:86-87) proposed *Eutamias* as the subgeneric name to include the western North American and Asiatic chipmunks.

Merriam (1897:189-190) raised *Eutamias* to full generic rank. In so doing he neither listed nor described any characters but wrote that "it will be observed that the name *Eutamias,* proposed by Trouessart in 1880 as a subgenus of *Tamias* is here adopted as a full genus. This is because of the conviction that the superficial resemblance between the two groups is accidental parallelism, in no way indicative of affinity. In fact the two groups, if my notion of their relationship is correct, had different ancestors, *Tamias* being an offshoot of the ground-squirrels of the subgenus *Ictidomys* of Allen, and *Eutamias* of the subgenus *Ammospermophilus,* Merriam."

Howell (1929:23) proposed *Neotamias* as the subgeneric name for the chipmunks of western North America, of the genus *Eutamias.*

Ellerman (1940, 1:426) gave *Eutamias* and *Neotamias* equal subgeneric rank with *Tamias* under the genus *Tamias;* on pages 427-428 he quoted Merriam, as I have done above, and later, after quoting the key to the genera and subgenera of chipmunks of Howell (1929:11), Ellerman wrote (*op. cit.:* 428-429), "This key

convinces me that all these forms must be referred to one genus only. The characters given to separate '*Eutamias*' from *Tamias* are based only on the absence or presence of the functionless premolar, and on the colour pattern. If colour pattern is to be used as a generic character, it seems *Citellus suslicus* will require a new name when compared with *C. citellus,* etc." And again, "The Asiatic chipmunk is intermediate between typical *Tamias* and the small American forms in many characters." To substantiate this, Ellerman (*loc. cit.*) quotes Howell (*loc. cit.*), in comparing the subgenera *Eutamias* and *Neotamias,* as follows: " 'the ears [of subgenus *Eutamias*] are broad, rounded, of medium height, much as in *Tamias;* postorbital broad at base, tapering to a point, much as in *Tamias;* interorbital constriction slight, as in *Tamias;* upper molariform tooth rows slightly convergent posteriorly, as in *Tamias.*' " Ellerman (*loc. cit.*) again quotes Howell (*loc. cit.*), " '*Eutamias* of Asia resembles *Tamias* of North America and differs from American *Eutamias* in a number of characters, notably the shape of the anteorbital foramen, the postorbital process, the breadth of the interorbital region, the development of the lambdoidal crest, and the shape of the external ears. On the other hand, American *Eutamias* agrees with the Asiatic members of the genus in the shape of the rostrum, the well-defined striations of the upper incisors, the presence of the extra peg-like premolar, and in the pattern of the dorsal stripes.' "

Bryant (1945:372) wrote, "I am convinced that Ellerman's interpretation of the relationships of the chipmunks is correct." After commenting that the presence or absence of P3, "is of significance only in distinguishing between species of squirrels," Bryant adds that "The other differences between the eastern and the western chipmunks do not appear to be of sufficient phylogenetic importance to warrant the retention of the two groups as genera."

METHODS, MATERIALS, AND ACKNOWLEDGMENTS

Characters previously mentioned in the literature as having taxonomic worth for supraspecific categories of chipmunks were checked by me on specimens old enough to have worn permanent premolars. Some structural features not previously used were found to have taxonomic significance. The baculum in each of the supraspecific categories of sciurids of North America was examined; the bacula were processed by the method described by White (1951:125) to obviate "variation" caused by shriveling of the smaller bacula or breaking of the more delicate parts of the larger bacula. Mallei and hyoid bones of the genera and subgenera of the chipmunks were mostly studied in the dry state.

Part of the hyoid musculature in these same groups of chipmunks was dissected.

In all, I studied more than 1,000 skulls and skins of the subgenus *Neotamias,* approximately 50 skulls and skins of *Tamias striatus,* and 15 skulls and skins of the subgenus *Eutamias* (*Eutamias sibiricus asiaticus* from Manchuria). Numerous other specimens were examined but not in such detail.

I am grateful to Professor E. Raymond Hall for guidance in the study. For encouragement and advice I am grateful also to Doctors Robert W. Wilson, Cecil G. Lalicker, Edwin C. Galbreath, Keith R. Kelson, E. Lendell Cockrum, Olin L. Webb, and others at the Museum of Natural History, and in the Department of Zoology of the University of Kansas. My wife, Alice M. White, made the drawings and helped me in many other ways. For lending specimens I thank Dr. David H. Johnson of the United States National Museum, and Dr. George C. Rinker of the Department of Anatomy, University of Michigan.

Assistance with field work is acknowledged from the Kansas University Endowment Association, the National Science Foundation, and the United States Navy, Office of Naval Research, through contract No. NR161 791.

Evaluation of Characters

The following paragraphs treat the characters listed by Howell, Ellerman, and Bryant, and such additional characters as I have found useful in characterizing the genera and subgenera of chipmunks. Some of the findings, I think, illustrate how study of such mammalian structures as the baculum, malleus, and hyoid apparatus —structures that seem to be little influenced by the changing external environment—clarifies relationships, if these previously were estimated only from other parts of the anatomy of Recent specimens.

The structural features and characters to be discussed, or listed, below may be arranged in three categories as follows: 1) Characters in which the subgenera *Eutamias* and *Neotamias* agree but are different from the genus *Tamias;* 2) Characters in which the subgenus *Eutamias* and the genus *Tamias* agree but are different from the subgenus *Neotamias;* 3) Structural features that are too weakly expressed to be of taxonomic use.

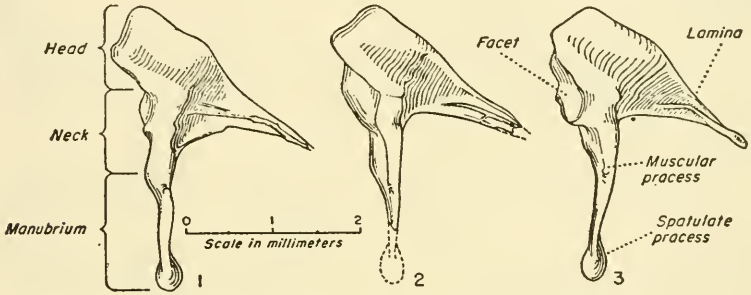
Characters in which the Subgenera Eutamias and Neotamias Agree, but Differ from the Genus Tamias

Structure of the Malleus.—The malleus in chipmunks is composed of a head and neck, a manubrium which has a spatulate process at the end opposite the head, and a muscular process situated about halfway between the spatulate process and the head of the malleus. An articular facet begins on the manubrium near the neck and spirals halfway around the head of the malleus. A lamina extends from the anterior edge of the head and neck, tapers to a point and joins the tympanic bulla anteriorly where there is a suture between

the lamina and bulla. The lamina is one half as long as the rest of the malleus (see figs. 1-3).

The head of the malleus in *Tamias* is clearly more elongated than in *Eutamias*. The plane formed by the lamina in *Eutamias* makes an angle of approximately 90 degrees with the plane formed by the manubrium; in *Tamias* the two planes make an angle of approximately 60 degrees.

Examination of series of mallei of *Eutamias* and *Tamias* indicate that there is slight individual variation, slight variation with age, and no secondary sexual variation. Intraspecific variation in the subgenus *Neotamias* is slight, consisting of differences in size. Specimens of the subgenus *Eutamias* from Manchuria have mallei which are morphologically close to the mallei of the subgenus *Neotamias*.



FIGS. 1-3. Dorsomedial views of left malleus.

FIG. 1. *Tamias striatus lysteri*, No. 11920 sex?; from Carroll Co., New Hampshire.

FIG. 2. *Eutamias sibiricus asiaticus*, No. 199637 male NM; from I-mien-po, N. Kirin, Manchuria.

FIG. 3. *Eutamias townsendii senex*, No. 165 male; from Lake Tahoe, California.

Structure of the Baculum.—In discussing the baculum in *Eutamias* and *Tamias*, it seems desirable to do so in the light of the structure of the baculum in other sciurids.

The bacula of North American sciurids are divisible into six distinct types represented by those of the genera *Spermophilus, Marmota, Sciurus, Tamiasciurus, Eutamias,* and *Glaucomys.*

The type of baculum in *Spermophilus* is spoonshaped with a ventral process that is spinelike or keellike. Also, spines usually are present along the margin of the "spoon." The base (proximal end) of the baculum is broad, and some species have a winglike process extending dorsally and partly covering a longitudinal groove. The

shaft is more or less curved downward in the middle (see figs. 7, 10).

In *Marmota* the baculum is greatly enlarged at the posterior end and forms a shieldlike surface. The ventral surface of the base is flattened and the ventral surface of the shaft curves slightly ventrally then dorsally to the tip. The dorsal region of the base culminates in a point, from which there is a ridge that extends anteriorly and that tapers rapidly into the shaft near the tip. The tip, dorsally, has a slight depression surrounded by knobs, which are more or less well defined, and which resemble, topographically, the spines described for *Spermophilus* (see fig. 8).

In *Sciurus* the baculum is semispoonshaped and asymmetrical. There is a winglike process on one side and a spine, which projects lateroventrally, on the other side of the tip. The base of the baculum is broad but not so broad as in most species of *Spermophilus*. Extending posteriorly from the region of the tip, at which point a spine projects lateroventrally, there is a ridge, which is often partly ossified and that extends to a point near the base (see fig. 4).

In *Tamiasciurus* the baculum is absent or vestigial (Layne, 1952:457-459).

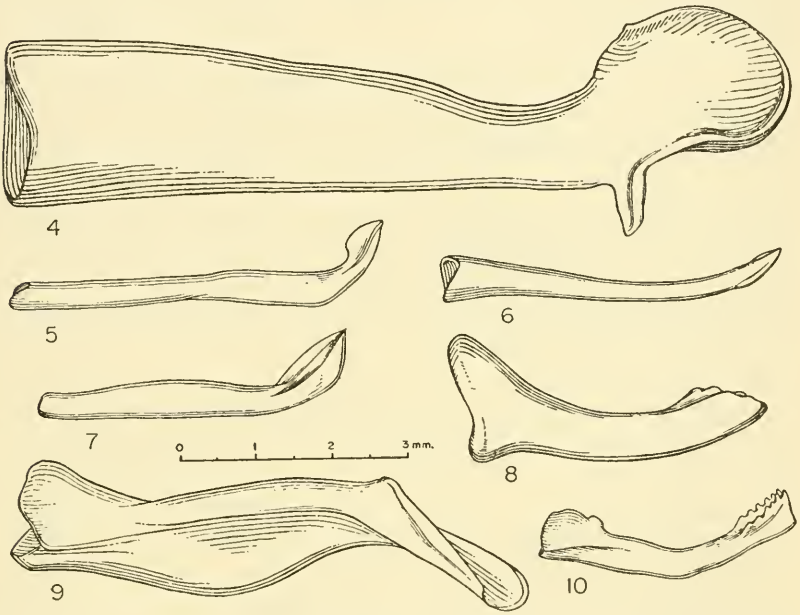
In *Eutamias* the baculum is broad at the base and the shaft tapers distally to the junction of the shaft and tip, or the base is only slightly wider than any part of the shaft. The tip often forms an abrupt angle with the shaft and there is a keel on the dorsal surface of the tip (see figs. 5, 6).

The baculum in *Glaucomys* is the most distinctive of that of any American sciurid. According to Pocock (1923:243-244), "The baculum [of *G. volans*] is exceedingly long and slender, slightly sinuous in its proximal third, and inclined slightly upwards distally. The extreme apex is bifid, the lower process being rounded, the upper more pointed. On the left side there is a long crest running from the summit of the upper terminal process and ending abruptly behind the left side about one-third of the distance from the proximal end of the bone. It lies over a well-marked groove, and there is a second shallower groove on the right side of the bone." The baculum of *G. sabrinus* is markedly wider, more flattened and shorter than in *G. volans*. The crest, which is also present in *G. volans*, starts from the upper terminal process and extends to the base of the baculum on the left side. There is a knoblike process on the crest at a point three fourths the length of the baculum from its base. The distal one third of the baculum curves sharply but smoothly upwards (see fig. 9).

Keeping in mind that the baculum in the North American sciurids can be classified into six structural groups, as given above, the baculum in each of the subgenera *Eutamias* and *Neotamias* and in the genus *Tamias* is briefly described.

In the subgenus *Neotamias* the baculum resembles a leg and foot of man, with a narrow ridge (keel) in the center of the "instep" of the foot (Howell 1929:27). The tip (= foot) curves dorsally at the distal end (see figs. 5, 6).

In the subgenus *Eutamias*, the baculum "tapers gradually from base to tip, the distal portion upturned in an even curve and slightly



FIGS. 4-10. Lateral views of right side (except left-lateral view in fig. 9) of baculum.

FIG. 4. *Sciurus aureogaster aureogaster,* No. 37000; from 70 km. S C. Victoria (by highway), and 6 km. W of highway, Tamaulipas.

FIG. 5. *Eutamias quadrimaculatus,* No. 95780 BS; from Mountains near Quincy, Plumas Co., California.

FIG. 6. *Eutamias sibiricus asiaticus,* No. 199632 NM; from 120 mi. up the Yalu River, Korea.

FIG. 7. *Tamias striatus lysteri,* No. 193493 NM; from Locust Grove, New York.

FIG. 8. *Marmota flaviventer dacota,* No. 41641; from 1½ mi. E Buckhorn, 6,150 ft., Weston Co., Wyoming.

FIG. 9. *Glaucomys sabrinus bangsi,* No. 15079; from 10 mi. NE Pinedale, 8,000 ft., Sublette Co., Wyoming.

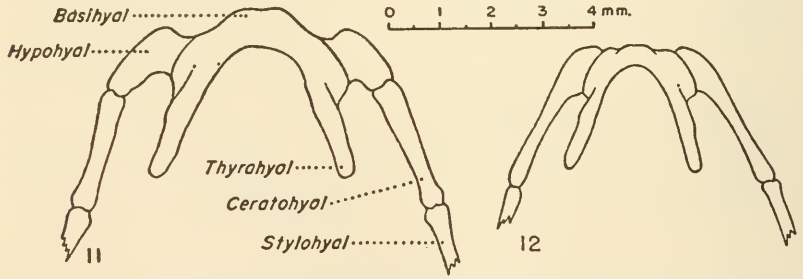
FIG. 10. *Spermophilus armatus,* No. 14888; from W end Half Moon Lake, 7,900 ft., Sublette Co., Wyoming.

flattened . . ." (*op. cit.*:26). Microscopic examination reveals that there is a faint keel on the dorsal surface of the tip.

Eutamias, like *Callosciurus, Menetes, Dremomys, Lariscus, Rhinosciurus,* and *Nannosciurus,* has a keel on the dorsal surface of the tip of the baculum (compare figures 5 and 6 with the descriptions and figures in Pocock, 1923:217-225).

In *Tamias* the baculum is "a slender bone 4.5-5 millimeters in length, nearly straight, upturned at the tip and slightly expanded into the shape of a narrow spoon or scoop, with a slight median ridge on the under surface." (Howell *op. cit.*:13.) The "median ridge" is a keel on the ventral surface. In having a keel on the ventral surface of the tip, the baculum of *Tamias* is comparable to that of *Spermophilus.*

Examination of series of bacula of the subgenus *Neotamias* and the genus *Tamias* indicates, as in the case of the mallei, that there is slight individual variation and slight variation with age. In the subgenus *Neotamias* interspecific variation in the baculum is considerable, but the general plan of structure remains constant. From this study of variation of the baculum in American chipmunks, it can be extrapolated that the baculum in the Asiatic *Eutamias* would show little individual variation in structure. I have seen only two bacula of the Asiatic *Eutamias.*



Figs. 11-12. Ventral views of the hyoid apparatus in *Tamias* and *Eutamias.*
Fig. 11. *Tamias striatus venustus,* No. 11072 female; from Winslow, Washington Co., Arkansas.
Fig. 12. *Eutamias minimus operarius,* No. 5376 male; from 14 mi. N El Rito, Rio Arriba Co., New Mexico.

Structure of the Hyoid Apparatus.—The hyoid apparatus in the chipmunks is made up of an arched basihyal with a thyrohyal attached to each limb of this "arch." To each junction between the "arch" and the thyrohyals, a hypohyal is attached by ligaments to a flat articular surface. A ceratohyal then is attached posteriorly to the hypohyal and a stylohyal ligament is attached to each ceratohyal

posteriorly. The stylohyal is loosely attached along its sides to the tympanic bulla and finally attached, at the posterior end, to the bulla at a point slightly ventral and posterior to the auditory meatus.

In the genus *Eutamias* the hypohyal and ceratohyal are completely fused in adults, the suture between these two bones being visible in juvenal specimens (see fig. 12).

In the genus *Tamias* the hypohyal and ceratohyal remain distinct throughout life. The hypohyal may frequently be divided into two parts, a variation which is also present in *Marmota.*

The musculature associated with the hyoid apparatus in *Eutamias* and *Tamias* is as described by Bryant (1945:310, 316) for the Nearctic squirrels. However, the conjoining tendon of the anterior and posterior pairs of digastric muscles is ribbonlike in *Eutamias* and rodlike (rounded in cross section) in *Tamias.*

The presence or absence of P3 and the projection of the anterior root of P4 in relation to the masseteric knob.—Only rarely is P3 absent in *Eutamias* or present in *Tamias.* P3 in specimens of old adult *Eutamias,* shows wear, thus suggesting that P3 is functional in older chipmunks. In *Eutamias,* which normally has a P3, the anterior root of P4 projects to the outside of the masseteric knob, whereas in *Tamias,* which normally lacks a P3, the anterior root of P4 projects directly to the masseteric knob or to the lingual side of this structure. The projection of the anterior root of P4 seems to be correlated with the presence or absence of P3. However, in a specimen of *Tamias striatus rufescens* (No. 11117 KU), the left P3 is present, yet the anterior root of P4 still projects to the lingual side of the masseteric knob.

Ellerman (1940:48) and Bryant (1945:368-369, 372) think that the presence or absence of P3 is not of generic significance in chipmunks, since P3 is vestigial and probably is in the process of being lost, and since this character is rarely used as a generic character in other sciurids. I think that the presence or absence of P3, together with the projection of the anterior root of P4 in relation to the masseteric knob, is of generic significance, for, squirrels in general have retained the dentition and dental formula of a primitive rodent, and any change in the pattern of the teeth or in dental formula is, in my opinion, of a fundamental nature.

Length of tail in relation to total length.—The tail in *Eutamias* is more than 40 per cent of the total length, whereas in *Tamias* the tail is less than 38 per cent of the total length. In this respect *Tamias* resembles most ground squirrels of the genus *Spermophilus.*

Color pattern.—The chipmunks vary but little in color pattern, for, even in *Eutamias dorsalis,* which is one of the most aberrant of the chipmunks in color pattern, the pattern is characteristic of *Eutamias.*

The width of the longitudinal stripes is uniform in *Eutamias* whereas in *Tamias* the dorsal, longitudinal light stripes are more than twice as wide as the other stripes.

In *Eutamias,* only the two lateralmost dark stripes are short, whereas in *Tamias* all four of the lateral dark stripes are short; none extends to the rump or to the shoulder.

The dark median stripe is present in both *Eutamias* and *Tamias* as well as in other genera such as *Callosciurus* and *Menetes* (Ellerman 1940:390).

Characters in which the Subgenus Eutamias and the Genus Tamias Agree, but Differ from the Subgenus Neotamias

Shape of the infraorbital foramen.—In the subgenus *Eutamias* and in the genus *Tamias* the infraorbital foramen is rounded, whereas in most species of the subgenus *Neotamias* the foramen is slitlike. In *Eutamias townsendii,* however, the infraorbital foramen is rounded as much as in the subgenus *Eutamias* and in the genus *Tamias.*

Width of the postorbital process at base.—The postorbital process is broader at the base in the subgenus *Eutamias* and in the genus *Tamias* than in most species of the subgenus *Neotamias.* In *E. townsendii,* however, this process is relatively as broad as in the subgenus *Eutamias* and in the genus *Tamias.*

Position of the supraorbital notch in relation to the posterior notch of the zygomatic plate.—In the subgenus *Eutamias* and in the genus *Tamias* the supraorbital notch is distinctly anterior to the posterior notch of the zygomatic plate, whereas in the subgenus *Neotamias,* the supraorbital notch is only slightly anterior to the posterior notch of the zygomatic plate. This difference may be correlated with differences in size, since specimens of the subgenus *Eutamias* and the genus *Tamias* are larger than specimens of the subgenus *Neotamias.*

Degree of convergence of the upper tooth-rows.—The rows of upper cheek-teeth converge posteriorly in the subgenus *Eutamias* and in the genus *Tamias,* except that in some specimens of *E. sibiricus asiaticus* the rows of upper cheek-teeth are nearly parallel to each other. In most species of the subgenus *Neotamias* the rows

of upper cheek-teeth are nearly parallel to each other, although in the specimens that I have seen of *E. townsendii,* the upper rows of cheek-teeth converge posteriorly.

Degree of constriction of the interorbital region.—The interorbital region is more constricted in most species of the subgenus *Neotamias* than in the subgenus *Eutamias* and the genus *Tamias.* In specimens of *E. t. townsendii* of the subgenus *Neotamias,* however, the degree of constriction of the interorbital region is approximately the same as in the subgenus *Eutamias* and the genus *Tamias.*

Shape of the pinna.—The pinna is narrower and more pointed in the subgenus *Neotamias* than in the subgenus *Eutamias* and the genus *Tamias.*

STRUCTURAL FEATURES THAT ARE TOO WEAKLY EXPRESSED TO BE OF TAXONOMIC USE

The following alleged characters have been mentioned in the literature. Since the degree of expression of these features is so slight, or since there is marked variation within one or more natural groups of chipmunks, no reliance is here placed on these features. They are as follows: (1) Degree of the posterior projection of the palate; (2) relative size of the auditory bullae; (3) position, in relation to P4, of the notch in the posterior edge of the zygomatic plate; (4) size of m3 in relation to m2; (5) degree of development of the mesoconid and ectolophid of the lower molars; (6) shape and length of the rostrum; (7) degree of distinctness of minute longitudinal grooves on the upper incisors.

A variation that does not readily fall in any one of the three categories mentioned above is the degree of development of the lambdoidal crest. The crest is least developed in the subgenus *Neotamias* and most developed in the genus *Tamias.* The larger the skull, the more the lambdoidal crest is developed; seemingly, therefore, the degree of development is an expression of size of the skull and may be determined by heterogonic growth.

DISCUSSION

As shown in table 1, there are ten characters by means of which *Eutamias* and *Tamias* can be separated consistently. The subgenus *Eutamias* occurs on the Asiatic side and the subgenus *Neotamias* occurs on the North American side of Bering Strait, yet the two subgenera agree in the ten features referred to. Although the subgenus *Neotamias* and the genus *Tamias* occur together in parts of the United States and Canada, they differ in the ten features, in-

dicating that the subgenera *Eutamias* and *Neotamias* are more closely related to each other than either is to *Tamias*.

It must be pointed out here that the subgenus *Neotamias* always differs from both the subgenus *Eutamias* and the genus *Tamias* in pointed *versus* rounded pinna of ear (see table 2) and in the supraorbital notch being slightly posterior to or even with, instead of distinctly anterior to, the posterior notch of the zygomatic plate. The relative position of these two notches, however, seems to be a matter of relative (heterogonic) growth. Further, the base of the postorbital process of the frontal usually is narrower (relative to the length of the process) in the subgenus *Neotamias* but there is

Table 1.—Characters by Means of Which the Genera Eutamias and Tamias Can Be Distinguished

Character	*Eutamias*	*Tamias*
Shape of head of malleus.	not elongated.	elongated.
Angle formed by planes of lamina and manubrium of malleus.	approximately 90 degrees.	approximately 60 degrees.
Position of keel on tip of baculum.	dorsal.	ventral.
Relation of hypohyal and ceratohyal bones of hyoid apparatus.	fused in adults.	never fused.
Appearance in cross section of conjoining tendon of anterior and posterior digastric muscles.	flattened.	rounded.
Presence or absence of P3.	present.	absent.
Projection of anterior root of P4 in relation to masseteric knob.	buccal.	lingual.
Length of tail in relation to total length.	more than 40 per cent.	less than 38 per cent.
Width of longitudinal stripes.	subequal.	median pair of light stripes twice as wide as others.
Length of lateral longitudinal light stripes.	outermost pair short.	both pairs short.

TABLE 2.—CHARACTERS BY MEANS OF WHICH THE SUBGENUS EUTAMIAS AND THE GENUS TAMIAS MAY BE DISTINGUISHED FROM THE SUBGENUS NEOTAMIAS

Character	subgenus *Neotamias*	subgenus *Eutamias*	genus *Tamias*
Shape of infraorbital foramen.	subovate to rounded.	always rounded.	always rounded.
Relative width of the postorbital process at base.	narrow to broad.	broad.	broad.
Position of supraorbital notch in relation to posterior notch of zygomatic plate.	even with or slightly posterior.	anterior.	anterior.
Convergence, posteriorly, of upper tooth-rows.	not always.	not always.	always.
Degree of constriction of interorbital region.	slight to marked.	marked.	marked.
Shape of pinna.	long and pointed.	broad and rounded.	broad and rounded.

a gradation in this feature in *Neotamias* culminating in the species *E. townsendii* in which the bases of the processes are relatively as broad as in the subgenus *Eutamias* and the genus *Tamias*. The same condition obtains in the shape of the infraorbital foramen which is subovate to rounded in the subgenus *Neotamias* and always rounded in the other chipmunks.

These differences of *Neotamias* are so slight in comparison with the similarities (ten features mentioned above) that *Neotamias* here is accorded only subgeneric rank under the genus *Eutamias*, instead of generic rank.

Howell's (1929) arrangement of the genera and subgenera of chipmunks is judged to be correct as indicated by the following arrangement that I propose.

GENERA AND SUBGENERA

Genus Eutamias Trouessart

Eutamias Trouessart, E. L. Catal. Mamm. viv. et foss., Rodentia, in Bull. Soc. d'Etudes Sci. d'Angers, 10:86-87, 1880. Type *Sciurus striatus asiaticus* Gmelin.

Eutamias, Merriam, C. H., Proc. Biol. Soc. Washington, 11:189-190, July 1, 1897.

Eutamias, Howell, A. H., N. Amer. Fauna, 52:26, November 30, 1929.
Tamias, Ellerman, J. R., The families and genera of living rodents. British Mus. (Nat. Hist.), 1:426, June 8, 1940.
Tamias, Bryant, M. D., Amer. Midland Nat., 33:732, March 1945.

Diagnosis.—Skull lightly built, narrow; postorbital process light and weak; lacrymal not elongated; infraorbital foramen lacks canal, relatively larger than in most sciurids; P3 present; head of malleus not elongated; plane of manubrium of malleus 90 degrees to plane of lamina; hypohyal and ceratohyal bones of hyoid apparatus fused in adults; conjoining tendon between anterior and posterior sets of digastric muscles ribbonlike; keel on dorsal side of tip of baculum; tail more than 40 per cent of total length; five longitudinal dark stripes evenly spaced and subequal in width; two lateral dark stripes short.

Subgenus Eutamias Trouessart

Eutamias Trouessart, E. L. Catal. Mamm. viv. et foss., Rodentia, in Bull. Soc. d'Etudes Sci. d'Angers 10:86-87, 1880. Type *Sciurus striatus asiaticus* Gmelin.
Eutamias, Howell, A. H., N. Amer. Fauna, 52:26, November 30, 1929.
Eutamias, Ellerman, J. R., The families and genera of living rodents. British Mus. (Nat. Hist.), 1:426, June 8, 1940.
Eutamias, Bryant, M. D., Amer. Midland Nat. 33:732, March 1945.

Diagnosis.—Size large; lambdoidal crest moderately developed; supraorbital notches distinctly anterior to posterior notch of zygomatic plate; baculum with faint keel on dorsal surface of tip which curves upward; pelage coarse; ears broad, rounded, of medium height.

Geographic range.—Palearctic. West to Dvina and Kama rivers, Vologda, and Kazan, in European Russia. South to southern Ural Mountains, Altai Mountains; Kansu, Szechwan, Shensi, Shansi, and Chihli provinces of China; Manchuria and Korea. East to Hokkaido Island, Japan; Kunashiri Island, southern Kurile Islands; Sakhalin Island, and Yakutsk, Siberia. North nearly to Arctic Coast in Siberia and European Russia (Ellerman and Morrison-Scott 1951:503).

Subgenus Neotamias Howell

Neotamias Howell, A. H., N. Amer. Fauna, 52:26, November 30, 1929. Type, *Eutamias merriami* J. A. Allen [= *Tamias asiaticus merriami* J. A. Allen].
Neotamias, Ellerman, J. R., The families and genera of living rodents. British Mus. (Nat. Hist.), 1:426, June 8, 1940.
Neotamias, Bryant, M. D., Amer. Midland Nat., 33:372, March, 1945.

Diagnosis.—Size small to medium; lambdoidal crest barely discernible; supraorbital notches even with, or posterior to, posterior notch of zygomatic plate; baculum with distinct keel on dorsal surface of tip which curves upward; pelage silky; ears long and pointed.

Geographic range.—Western Nearctic. West to Pacific Coast. South to Lat. 20°30′ in Baja California and to northwestern Durango and southeastern Coahuila, Mexico. East to eastern New Mexico, westernmost Oklahoma, eastern Colorado, Wyoming, northwestern Nebraska, western and northwestern South Dakota, western and northwestern North Dakota, northeastern Minnesota, northern Wisconsin and Upper Peninsula of Michigan, and eastern Ontario.

North to southwestern shore of Hudson Bay, southern shore of Great Slave Lake and Yukon River, Yukon.

Genus Tamias Illiger

Tamias Illiger, J. K. W., Prodromus Syst. Mam. Avium, pp. 83, 1811. Type, *Sciurus striatus* Linnaeus.
Tamias, Howell, A. H., N. Amer. Fauna, 52:26, November 30, 1929.
Tamias, Ellerman, J. R., The families and genera of living rodents. British Mus. (Nat. Hist.), 1:426, June 8, 1940.
Tamias, Bryant, M. D., Amer. Midland Nat. 33:372, March, 1945.

Diagnosis.—Skull lightly built, narrow; postorbital process small and weak; lacrimal not elongated; infraorbital foramen lacks canal, relatively larger than in most sciurids; P3 absent; head of malleus elongated; plane of manubrium of malleus forms 60 degree angle with plane of lamina; hypohyal and ceratohyal bones of hyoid apparatus fused in adults; conjoining tendon of anterior and posterior digastric muscles rounded in cross section; keel on ventral surface of tip which curves upward in baculum; tail less than 38 per cent of total length; five longitudinal dark and four longitudinal light stripes present but two dorsal light stripes at least twice as broad as other stripes; four lateral dark stripes short.

Geographic range.—Eastern Nearctic. West to Turtle Mountains, North Dakota; eastern North Dakota, eastern South Dakota, Nebraska, Kansas, and Oklahoma. South to southern Louisiana, Mississippi, Alabama, northwestern Georgia. East to Atlantic Coast from South Carolina to Nova Scotia. North to northeastern Quebec and southern tip of Hudson Bay.

Discussion

Chipmunks are small striped squirrels that inhabit the Holarctic Realm and that are found in similar niches in each of the three regions: Palearctic, western Nearctic, and eastern Nearctic. Ellerman (1940) and Bryant (1945) placed the chipmunks in three subgenera, corresponding to the regions mentioned above, under the one genus *Tamias.* Critical examination of new and old evidence reveals, nevertheless, that the subgenera *Eutamias* and *Neotamias* of the genus *Eutamias* are more closely related to one another than either is to the genus *Tamias.* This relationship can be seen clearly in the structure of the malleus, baculum, hyoid apparatus, hyoid musculature, the presence or absence of P3, the projection of the anterior root of P4 in relation to the masseteric knob, and in the color pattern.

Because the genera *Eutamias* and *Tamias* occupy similar ecological niches, the structural similarities that permit these animals to be called chipmunks, show convergence, and thus can be assumed to be adaptive. These similarities are in the molars, in shape of the skull, in color pattern and in other features which have been used

by many systematists to interpret the phylogenetic relationships of the squirrels. Pocock (1923:211), however, reviewed the taxonomic literature on sciurids and wrote: "The conclusion very forcibly suggested by the literature of the subject is the untrustworthiness of such characters." Pocock (*op. cit.*), correctly in my opinion, then established a supraspecific classification of the sciurids based almost exclusively on the structure of the baculum and glans penis. I have studied the baculum in chipmunks and in all the major supraspecific groups of Nearctic squirrels. The bacula of the Nearctic squirrels and those of the Palearctic and Indian squirrels, other than the chipmunks, are described and figured by Pocock (*op. cit.*).

The baculum in *Eutamias,* in general plan of structure, resembles the baculum in the genera *Callosciurus, Menetes, Rhinosciurus, Lariscus, Dremomys,* and *Nannosciurus,* of the tribe Callosciurini Simpson. The baculum in *Tamias,* in general plan of structure, resembles that in *Spermophilus* (= *Citellus*) and *Cynomys* of the tribe Marmotini Simpson. These tribes, designated by Simpson (1945:79), are based on the corresponding subfamilies defined by Pocock (1923:239-240) primarily on differences in the structure of the baculum. I assign *Tamias* to the tribe Marmotini. I assign *Eutamias* to the tribe Callosciurini, but do so only tentatively because I have not, at first hand, studied the bacula of most of the Callosciurini. The fossil record is too incomplete to reveal the time when the two tribes diverged. The subgenera *Eutamias* and *Neotamias* are closely related. Indications are that the divergence of the two subgenera occurred, geologically, but a short time ago, possibly in Pleistocene time.

Conclusions

1. *Eutamias* and *Tamias* are distinct genera of chipmunks.

2. The subgenera *Eutamias* and *Neotamias* are valid, for, *Eutamias sibiricus* differs from all the species of the subgenus *Neotamias* to a greater degree than these species differ from one another.

3. The genera *Eutamias* and *Tamias* probably evolved from two distinct lines of sciurids; one line (*Eutamias*) is represented by the tribe Callosciurini, and the other (*Tamias*) by the tribe Marmotini.

Literature Cited

Catesby, M.
1743. The natural history of Carolina, Florida, and the Bahama Islands, etc., 2:i-xliv, 1-20, 1-100.

Ellerman, J. R.
1940. The families and genera of living rodents. British Mus. (Nat. Hist.), Vol. 1, pp. xxvi + 689, 189 figs., June 8.

Ellerman, J. R., and T. C. S. Morrison-Scott.
1951. Checklist of Palearctic and Indian mammals. British Mus. (Nat. Hist.), pp. 1-810, 1 map, November 30.

Gmelin, J. F.
1788. Systema Naturae. 1:1-500.

Howell, A. H.
1929. Revision of the American chipmunks (genera *Tamias* and *Eutamias*). N. Amer. Fauna 52:1-157, 10 pls., 9 maps, November 30.

Illiger, J. K. W.
1811. Prodromus systematis mammalium et avium additis terminis zoographicis utriuque classis. pp. xviii + 302, C. Salfeld.

Laxmann, M. E.
1769. Sibiriche Brief, pp. iv + 104, Gottingen and Gotha.

Layne, J. N.
1952. The os genitale of the red squirrel, *Tamiasciurus*. Jour. Mamm. 33:457-459, 1 fig., November 19.

Linnaeus, C.
1758. Systema Naturae. 1:1-824.

Merriam, C. H.
1897. Notes on the chipmunks of the genus *Eutamias* occurring west of the east base of the Cascade-Sierra system, with descriptions of new forms. Proc. Biol. Soc. Washington, 11:189-212, July 1.

Pocock, R. I.
1923. The classification of the Sciuridae. Proc. Zool. Soc. London, 1923: 209-246, June.

Say, T. (*in* Edwin James).
1823. Account of an expedition from Pittsburgh to the Rocky Mountains, performed in the years 1819 and 1820, under the command of Major Stephen H. Long. From the notes of Major Long, Mr. T. Say, and other gentlemen of the exploring party. Compiled by Edwin James. Vol. 1, pp. 1-503; Vol. 2, pp. 1-442 + appendix i-xcviii.

Schreber, J. C. D.
1785. Saugthiere, 4:790-802.

Simpson, G. G.
1945. The principles of classification and a classification of mammals. Bull. Amer. Mus. Nat. Hist., 85:xvi + 350, October 5.

Trouessart, E. L.
1880. Catalogue des mammiferes vivants et fossiles. Ordre des Rongeurs. Bull. Soc. d'Etudes Sci. d'Angers, 10:58-212.

White, J. A.
1951. A practical method for mounting the bacula of small mammals. Jour. Mamm. 32:125, February 15.

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Taxonomy of the Chipmunks, Eutamias quadrivittatus and Eutamias umbrinus

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Taxonomy of the Chipmunks, Eutamias quadrivittatus and Eutamias umbrinus

By

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The differences in anatomy and color between many species of chipmunks are subtle, and refined techniques are required to discover them. When "measuring" chipmunks taxonomically, it is necessary to use a "chipmunk scale" and not, for example, a "pocket-gopher scale." In explanation, some species of pocket gophers closely allied to each other, and even some subspecies of the same species, differ markedly in color and in size and shape of parts of the skeleton; comparable differences are not so pronounced among many species of chipmunks.

Historical Summary

Merriam (1905) was the first to show clearly that *Eutamias quadrivittatus* is a distinct species, and pointed out that *E. amoenus operarius* (= *E. minimus operarius*) is a small species which resembles, and is found in some areas together with, *E. quadrivittatus.*

Howell (1929) placed under *E. quadrivittatus* the following subspecies: *E. q. quadrivittatus, E. q. hopiensis, E. q. inyoensis, E. q. frater, E. q. sequoiensis,* and *E. q. speciosus.*

Hardy (1945) placed *E. adsitus* under *E. quadrivittatus* as *E. q. adsitus,* and Kelson (1951) placed *E. umbrinus* under *E. quadrivittatus* as *E. q. umbrinus.*

Johnson (1943) re-established *E. speciosus* as a separate species, and in California left only *E. q. inyoensis* in *E. quadrivittatus.*

Thus, since 1943 the recognized subspecies of *E. quadrivittatus* have been: *E. q. quadrivittatus, E. q. hopiensis, E. q. inyoensis, E. q. nevadensis, E. q. umbrinus,* and *E. q. adsitus.*

Methods, Materials, and Acknowledgments

Capitalized color terms, which are used in descriptions and comparisons, are of Ridgway, "Color Standards and Color Nomenclature," Washington, D. C., 1912.

In the synonymy of each subspecies there appears only the first usage of a name, second the first usage of the name combination now employed unless a new combination is proposed by me, and third pure synonyms. The last is recognizable as such because the type locality is appended to each.

Unless otherwise specified, all specimens are in the Museum of Natural History, University of Kansas. The various collections of institutions and of private persons are indicated by the following symbols:

AM—American Museum of Natural History.
BS—United States Biological Surveys Collection.
CM—Colorado Museum of Natural History.
DC—Collection of Donald R. Dickey (now the collection of the University of California at Los Angeles).
FC—Collection of James S. Findley.
KU—Museum of Natural History, University of Kansas.
MM—Museum of Zoology, University of Michigan.
NM—United States National Museum.
UU—Museum of Zoology, University of Utah.
WC—Collection of Edward R. Warren, Colorado College.

Of the external measurements, only the total length and the length of the tail are recorded in table 1. Some field collectors measured the ear from the notch and others from the crown; most collectors measured the length of the hind foot to the nearest millimeter rather than in tenths of a millimeter, as would have been desired. Consequently, I decided against using the lengths of the ear and hind foot in the study here reported on.

The measurements of the skull were made as shown in figure 1.

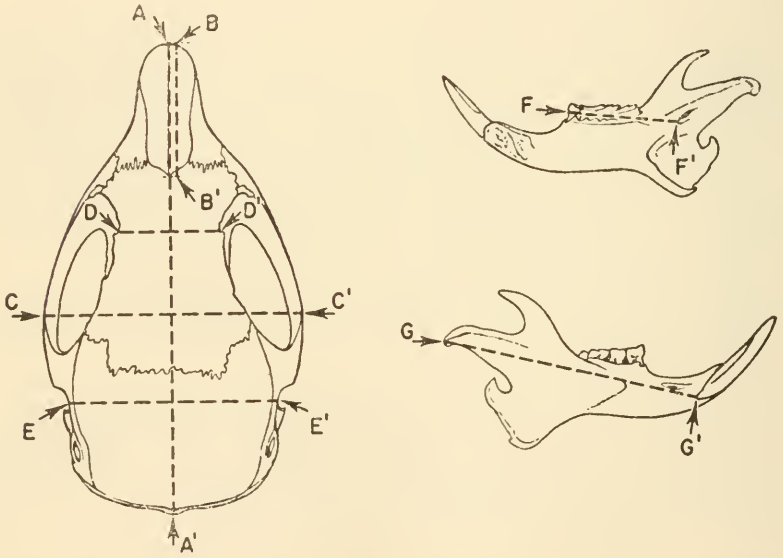


Fig. 1. Dorsal view of skull and a lateral and a medial view of the right lower jaw to show points between which measurements of the skull were taken. × 1¾. Based on *Eutamias ruficaudus ruficaudus*, from 6 mi. S St. Mary, 6500 ft., Glacier Co., Montana. A to A'—greatest length of skull; B to B'—length of nasals; C to C'—zygomatic breadth; D to D'—least interorbital constriction; E to E'—cranial breadth; F to F'—inner mandibular length; G to G'—condylo-alveolar length of mandible.

A total number of 434 specimens are listed as examined in this study, and additionally, numerous other specimens were superficially examined in the United States Biological Surveys Collection. Bacula of each of the named kinds of chipmunks in this paper, were examined.

Whenever two or more samples are stated to be significantly different, the meaning is that the difference is statistically significant.

The geographic distribution of each subspecies and the localities of specimens or series of specimens are plotted on the map (fig. 2).

When comparisons were made to ascertain specific and subspecific differences, only adults, or animals in which the enamel was worn through on the permanent P4 and p4 were used. Within this age range, only specimens in comparable pelage were used to ascertain differences in color.

Miss Viola S. Schantz of the United States Fish and Wildlife Service, Mr. Alfred Bailey of the Colorado Museum of Natural History, Dr. W. H. Burt of the Museum of Zoology of the University of Michigan, Dr. Stephen D. Durrant of the Museum of Zoology of the University of Utah, Dr. Robert M. Stabler, curator of the Warren Collection of Colorado College, and Mr. James S. Findley, generously loaned specimens for my use. Doctors E. Raymond Hall, Rollin H. Baker, Robert W. Wilson, Keith R. Kelson, E. Lendell Cockrum, and other friends and associates have given valued suggestions and assistance. My wife, Alice M. White, made the illustrations and helped me record and analyze the data.

Assistance with field work is acknowledged from the Kansas University Endowment Association, the National Science Foundation, and the United States Navy, Office of Naval Research, through contract No. NR161 791.

ACCOUNTS OF SPECIES AND SUBSPECIES

Eutamias quadrivittatus (Say)

Diagnosis.—Size medium; general tone of upper parts tawny; cranial breadth averaging between 16.0 and 16.8 mm.; baculum distinguishable from that of any other species by the combination of width of base less than ¼ of length of shaft, shaft having a maximum diameter of more than ¼ mm., and height of keel ¼ of length of tip.

Eutamias quadrivittatus quadrivittatus (Say)

Sciurus quadrivittatus Say, in Jones, Long's Expedition to Rocky Mountains, 2:45,1823.

Eutamias quadrivittatus, Miller and Rehn, Proc. Boston Soc. Nat. Hist., 30:43, December 27, 1901.

Tamias quadrivittatus gracilis J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:99, June 1890, Type from San Pedro, Santa Fe Co., New Mexico.

Eutamias quadrivittatus animosus Warren, Proc. Biol. Soc. Washington, 22:105, June 25, 1909. Type from Irwin Ranch, Las Animas County, Colorado.

Type.—None designated; from along Arkansas River, about 26 mi. below Canon City, Fremont County, Colorado; obtained on July 18, 1820.

Diagnosis.—Size medium; dorsal dark stripes blackish; sides Cinnamon to Clay Color; crown Light Drab; baculum large.

Description.—Color pattern: Head Cinnamon, shaded on crown to Light Drab; ocular stripe Fuscous Black, with Cinnamon along margins; other facial stripes Fuscous mixed with Cinnamon; ears Fuscous Black, Ochraceous-Tawny on anterior margin, grayish white on posterior margin and on postauricular

patch; dark dorsal stripes black with Ochraceous-Tawny along margins; outer pair of dark stripes often mainly Tawny; light dorsal stripes grayish white, outer pair usually creamy white; sides Ochraceous-Tawny, shaded in the region of the shoulder with Cinnamon; rump and thighs Cinnamon-Buff mixed with Smoke Gray; antipalmar surfaces of forefeet Cinnamon-Buff; antiplantar surfaces of hind feet Pinkish Buff; dorsal surface of tail Fuscous Black, overlaid with Pinkish Buff; ventral surface of tail Ochraceous-Tawny, Fuscous Black along margin, Pinkish Buff along outermost edge; underparts creamy white. *Skull:* Large; braincase well inflated; zygomatic arches strong and slightly appressed to skull. *Baculum:* Large; long and slender.

Comparisons.—From *E. q. hopiensis,* the only other subspecies in this species, *E. q. quadrivittatus* differs in: Dorsal dark stripes blackish; crown grayer; rump and thighs grayer; general tone of upper parts darker.

Remarks.—Specimens from the Chuska Mountains, Zuni Mountains, and Blanco, New Mexico, are intergrades between *E. q. quadrivittatus* and *E. q. hopiensis,* but are referable to *E. q. quadrivittatus.*

In north-central Colorado *E. umbrinus* occurs in the spruce and pine forests at higher altitudes, while to the south and east of this area *E. q. quadrivittatus* occurs in growths of piñon in lower, semiarid areas. In the northern half of New Mexico and in south-central Colorado, *E. q. quadrivittatus* occurs not only in semiarid habitats but also in the moist habitats of the forests of higher altitudes. Ecologically, *E. umbrinus* thus replaces *E. q. quadrivittatus* in north-central Colorado. This ecological replacement is comparable to the ecological replacement of *Thomomys bottae* by *T. talpoides* in Utah as shown by Durrant (1952:156).

Specimens examined.—Total number, 130.

Colorado: *Larimer Co.:* Arkins, 1 BS. *Jefferson Co.:* W spur Lookout Mountain, near Golden, 1 WC. *Gunnison Co.:* Sapinero, 3 BS. *Saguache Co.:* 5 mi. N and 22 mi. W Saguache 10,000 ft., 1; 21 mi. W and 3 mi. N Saguache, 1. *Fremont Co.:* 18 mi. S and 7 mi. W Colorado Springs, 1; Arkansas River, "about" 26 mi. below Canon City, 15 BS. *San Juan Co.:* Silverton, 1 BS. *Mineral Co.:* 3 mi. E Creede, 1. *Alamosa Co.:* Sangre de Cristo Range, 24 mi. E Hooper, 2 CM. *La Plata Co.:* 2 mi. NE Bondad 6,100 ft., 1; Bondad, 15 mi. S Durango 6,050 ft., 1. *Archuleta Co.:* Chromo, 1 CM. *Las Animas Co.:* Trinidad, 6 BS. *Baca Co.:* unspecified, 1.

New Mexico: *San Juan Co.:* Blanco, 1 BS; Chuska Mountains, 8 BS. *Rio Arriba Co.:* 8 mi. N El Rito, 1; 4 mi. N El Rito, 5; Rim Rock, El Rito, 2; 2 mi. E El Rito, 7,000 ft., 1; 2 mi. SE El Rito, 1; 6 mi. E and ½ mi. S Truchas, 8,500 ft., 1; 2 mi. S and 4 mi. W Coyote, 8,100 ft., 1; unspecified, 2. *Taos Co.:* 3 mi. N Taos Pueblo, 5 BS; 23 mi. S and 6 mi. E Taos, 8,750 ft., 2. *Union Co.:* Emery Peak, 1 BS; Folsom, 3 BS; Sierra Grande, 8 BS; unspecified, 2. *McKinley Co.:* Bear Ridge, Zuni Mountains, 9 BS. *Sandoval Co.:* Bear Canyon, W foothills, Sandia Mountains, 3 BS; W foothills, near S end, Sandia Mountains, 7 BS. *Santa Fe Co.:* San Pedro, 7 BS. *San Miguel Co.:* Canadian River, 4 mi. NW Tucumcari, 1 BS. *Valencia Co.:* Mount Taylor, San Mateo Mountains, 10 BS.

Oklahoma: *Cimarron Co.:* Kenton, 1 BS.

Eutamias quadrivittatus hopiensis Merriam

Eutamias hopiensis Merriam, Proc. Biol. Soc. Washington, 18:165, June 29, 1905.

Eutamias quadrivittatus hopiensis, Howell, Jour. Mamm. 3:184, August 4, 1922.

Type.—Female, adult, skull and skin, No. 67768 U. S. Nat. Mus.; from Keams Canyon, Painted Desert, Arizona; obtained on July 27, 1894, by A. K. Fisher.

Diagnosis.—Size medium; dorsal dark stripes tawny; crown Drab-Gray; baculum of same proportions as in *E. q. quadrivittatus* but smaller.

Description.—*Color pattern:* Head Drab-Gray, with Snuff Brown around margin of crown; facial stripes Sayal Brown with small blackish patches around eye; ears Ochraceous Tawny anteriorly and Pinkish Buff posteriorly; dorsal

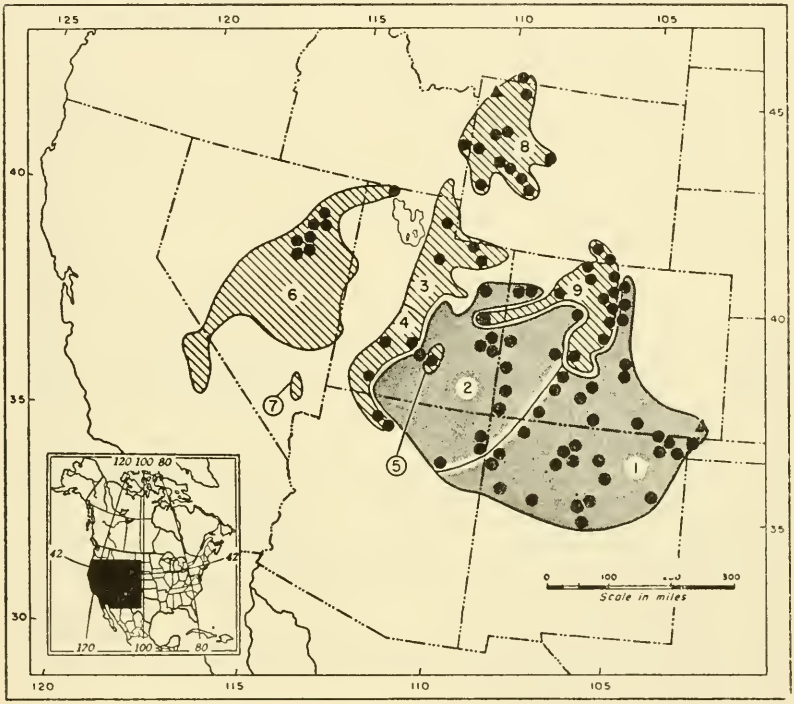


FIG. 2. Localities of specimens examined and probable geographic ranges of the subspecies of *Eutamias quadrivittatus* and *Eutamias umbrinus*. The symbols for locality records are as follows: circles, precise localities; triangles, localities known only to county.

Guide to subspecies:

1. *E. q. quadrivittatus*
2. *E. q. hopiensis*
3. *E. u. umbrinus*
4. *E. u. adsitus*
5. *E. u. sedulus*
6. *E. u. inyoensis*
7. *E. u. nevadensis*
8. *E. u. fremonti*
9. *E. u. montanus*

stripes Tawny, median one sometimes blackish; median pair of dorsal light stripes grayish white, outer pair creamy white; sides Ochraceous Tawny; rump and thighs Cinnamon Buff washed with Pale Smoke Gray; antipalmar and antiplantar surfaces of feet Pinkish Cinnamon; dorsal surface of tail Fuscous Black; ventral surface of tail Ochraceous Tawny, Fuscous Black along margin, Cinnamon Buff along outermost edge; underparts creamy white. *Skull:* As in *E. q. quadrivittatus. Baculum:* Same proportions as in *E. q. quadrivittatus* but smaller.

Comparisons.—See under the account of *E. q. quadrivittatus.*

Remarks.—Topotypes of this subspecies are intergrades between it and *E. q. quadrivittatus.*

In a large part of the geographic range of *E. q. hopiensis* there are numerous, massive outcrops of Mesozoic sandstones, which tend to form cliffs, that are brightly colored with many shades of red. The color which is characteristic of *E. q. hopiensis* seems to be helpful in adapting this subspecies to this habitat of red sandstone, for these chipmunks are generally found in the rubble and among the piñon at the base of the cliffs. At many places in Utah above these cliffs of red sandstone there are forests predominantly composed of yellow pine. Kelson (1951:42-43) states that "these two habitats are in immediate juxtaposition, the transition from one to the other often occurring in only a few feet . . ." and again, "No one to my knowledge, has found any evidence in specimens from Utah of interbreeding of *E. q. hopiensis* with either *E. q. adsitus* [= *E. umbrinus adsitus*] or *E. q. umbrinus* [= *E. u. umbrinus*]." Benson (1935:449) states, "On Navajo Mountain these chipmunks [*E. q. hopiensis*] were most in evidence on rock outcrops surrounded by brush at the lower edge of the yellow pine zone. One was seen at about 9,500 feet in a south-facing rock outcrop near the spruce-fir forest, but no chipmunk of any kind was seen in the forest itself." This suggests that where only *E. q. hopiensis* occurs on a mountain this subspecies goes higher than on a mountain where *E. u. adsitus* also occurs. This same relationship between *E. q. quadrivittatus* and the subspecies of *E. umbrinus* that occurs in north-central Colorado was pointed out in the account of *E. q. quadrivittatus.*

Specimens examined.—Total number, 68.

Utah: *Uintah Co.:* E side of confluence of Green and White rivers, 1 mi. SE Ouray, 4,700 ft., 3 UU. *Grand Co.:* Colorado River above Moab, 1 UU; side canyon of Colorado River above Moab, 1 UU; Moab, up Colorado River, 1 UU; Moab, 4,500 ft., 4 UU; Moab Bridge over Colorado River, 3,995 ft., Moab, 1 UU; Colorado River, 5 mi. E Moab Bridge, 4,000 ft., 1 UU. *Wayne Co.:* Fruita, 1 UU.

Colorado: *Moffat Co.:* 11 mi. W and 11 mi. N Rangely, 6,000 ft., 3. *Rio Blanco Co.:* White River, 5 BS. *Eagle Co.:* McCoy, 2 BS. *Mesa Co.:* 1¼ mi. S Loma, 4,600 ft., 1. *Gunnison Co.:* 1 mi. E Somerset, 6,100 ft., 1. *Montrose Co.:* 1 mi. E Naturita, 5,900 ft., 1. *Dolores Co.:* 1 mi. N Cahone, 6,900 ft., 1. *Montezuma Co.:* 1 mi. S Cortez, 5,000 ft., 1; Mesa Verde, 25 mi. SW Mancos, 7,000 ft., 2 BS.

Arizona: *Navajo Co.:* Keams Canyon, 80 mi. N Holbrook, 15 BS. *Apache Co.:* Summit, 8,000 ft., Luka Chukai Mountains, 15 mi. E Luka Chukai Navajo School, 8 BS; Wheatfield Creek, W slope Tunicha Mountains, 7,000 ft., 3 BS.

Eutamias umbrinus (J. A. Allen)

Diagnosis.—Size medium; pelage dark; sides dark; narrow cranial breadth; baculum distinguishable from that of any other species (*E. palmeri* excepted) by the combination of width of base more than ⅓ of length of shaft, distal ½ of shaft laterally compressed, and keel ¼ of length of tip.

Eutamias umbrinus umbrinus (J. A. Allen)

Tamias umbrinus J. A. Allen, Bull. Amer. Mus. Nat. Hist. 3:96, June, 1890.
Eutamias umbrinus, Miller and Rehn, Proc. Boston Soc. Nat. Hist. 30:45, December 27, 1901.

Type.—Male, adult, skull and skin, No. 186463 U. S. Nat. Mus., Biol. Surv. Coll.; from Blacks Fork, about 9,500 ft., Uinta Mountains, Utah; obtained on September 19, 1888, by Vernon Bailey; original No. 228.

Diagnosis.—Size medium; general tone of upper parts dark and shadowy; skull relatively small.

Description.—Color pattern: Head Pale Smoke Gray; facial stripes Fuscous Black to Snuff Brown; ear Fuscous Black; posterior margin of ear and postauricular patch grayish white; median dorsal dark stripe black with Sayal Brown along margins; lateral pair of dorsal dark stripes Sayal Brown or Fuscous Black mixed with Sayal Brown; outermost pair of dorsal dark stripes nearly absent; sides Sayal Brown mixed with Cinnamon; rump and thighs Sayal Brown mixed with Smoke Gray; antipalmar and antiplantar surfaces of feet Cinnamon-Buff; ventral surface of tail Ochraceous Tawny or Sayal Brown, with Fuscous Black around margin and Pinkish Buff around outermost edge; underparts creamy white with dark gray underfur. *Skull:* Large, with moderately inflated braincase and well developed zygomata. *Baculum:* One of the largest in the species.

Comparisons.—From *Eutamias umbrinus adsitus,* the subspecies to the south on the Wasatch Range, *E. u. umbrinus* differs in: Sides lighter; rump browner; hairs around outermost edge of tail tawnier (in freshly molted tails); shorter inner mandibular length.

From *E. u. inyoensis,* the subspecies to the west in central and northeastern Nevada and in northwestern Utah, *E. u. umbrinus* differs in: General tone of upper parts lighter; sides lighter; total length more; interorbital region broader.

For comparisons with *E. u. sedulus, E. u. fremonti,* and *E. u. montanus,* see the accounts of those subspecies.

Specimens examined.—Total number, 55.

Wyoming: *Uinta Co.:* 9 mi. S Robertson, 8,000 ft., 15; 10 mi. S and 1 mi. W Robertson, 8,700 ft., 5; 11½ mi. S and 2 mi. E Robertson, 9,200 ft., 1; 2 mi. E and 12 mi. S Robertson, Ashley Nat. For., 1; 13 mi. S and 2 mi. E Robertson, 9,200 ft., 1.

Utah: *Rich Co.:* Monte Cristo, 18 mi. W Woodruff, 8,000 ft., 2 UU. *Summit Co.:* 13½ mi. S and 2 mi. E Robertson [Wyoming], 4; 1 mi. N Bridger Lake R. S., 9,400 ft., 4. *Wasatch Co.:* Snake Creek Canyon, 3 mi. NW Midway, 6,000 ft., 1 UU. *Uintah Co.:* Paradise Park, 21 mi. W and 15 mi. N Vernal, 10,050 ft., 20.

Eutamias umbrinus adsitus J. A. Allen

Eutamias adsitus J. A. Allen, Brooklyn Institute Mus. Sci. Bull. 1:118, March 31, 1905.

Type.—Unsexed adult, skull and skin, No. 28728 Amer. Mus. Nat. Hist.; from Briggs Meadow, 10,000 ft., Beaver Mountains, Utah; obtained on August 20, 1904, by George P. Engelhardt.

Diagnosis.—Size medium; sides dark; general tone of upper parts dark; dorsal light and dark stripes strongly contrasting.

Description.—Color pattern: Head Cinnamon mixed with grayish white; stripe on margin of crown Verona-Brown or Bister; ocular stripe Fuscous Black mixed with Sayal Brown; submalar stripe Sayal Brown; ear Fuscous, Sayal Brown along anterior margin and Smoke Gray along posterior margin and on postauricular patch; median dorsal stripe black; lateral dorsal dark stripes Fuscous Black mixed with Russet; outermost dorsal dark stripes slightly darker or indistinguishable from sides in color; dorsal light stripes grayish white with Mikado-Brown along margins; outermost pair of dorsal light stripes nearly pure white; sides Russet mixed with Cinnamon or Ochraceous-Tawny; rump and thighs Smoke Gray mixed with Cinnamon-Buff, with a larger or smaller number of Fuscous Black hairs; antipalmar and antiplantar surfaces of feet Cinnamon-Buff; dorsal surface of tail black; ventral surface of tail Sayal Brown to Tawny; underparts white with dark underfur. *Skull* and *Baculum:* As in *E. u. umbrinus.*

Comparisons.—From *E. u. inyoensis,* the subspecies to the west, *E. u. adsitus* differs in: General tone of upper parts darker; sides darker; interorbital region wider; skull significantly deeper.

For comparison with *E. u. umbrinus, E. u. sedulus,* and *E. u. montanus,* see the accounts of those subspecies.

Remarks.—Specimens from West Rim, Zion National Park, 6,500 ft., Washington County, Utah, seem to be intergrades between *E. u. adsitus* and *E. u. inyoensis,* and are referable to *E. u. adsitus.*

Specimens examined.—Total number, 34.

Utah: *Beaver Co.:* Britts Meadow, Beaver Range Mountains, 8,500 ft., 13 BS. *Wayne Co.:* Donkey Lake, Boulder Mountain, 10,000 ft., 4 UU. *Garfield Co.:* Wildcat R. S., Boulder Mountain, 8,700 ft., 5 UU.

Arizona: *Coconino Co.:* De Motte Park, Kaibab Plateau, 3 BS; Bright Angel, Kaibab Plateau, 9 BS.

Eutamias umbrinus sedulus new subspecies

Type.—Male, adult, skull, skin, and baculum, No. 158181 U. S. Nat. Mus. Biol. Surv. Coll.; from Mount Ellen, Henry Mountains, Garfield County, Utah; obtained on October 13, 1908 by W. H. Osgood; original No. 3667.

Diagnosis.—Size medium; general tone of upper parts dark reddish-brown; ventral surface of tail Ochraceous-Orange; sides Mars Yellow.

Description.—Color pattern: Crown Drab-Gray mixed with Fuscous; upper facial stripe Fuscous Black mixed with Sudan Brown; ocular stripe Sudan Brown mixed with black; submalar stripe Sudan Brown slightly mixed with black; anterior margin of ear Sudan Brown slightly mixed with black; hairs inside pinna, posteriorly, Warm Buff; posterior margin of ear and postauricular patch creamy white; median dorsal dark stripe black with Antique Brown along margins; lateral dorsal dark stripes black mixed with Antique Brown; outermost dorsal dark stripes Xanthine Orange slightly mixed with black; median dorsal light stripes Pale Smoke Gray; outermost dorsal light stripes white slightly mixed with gray; rump and thighs Smoke Gray; sides Mars Yellow; dorsal surface of tail black mixed with Warm Buff; ventral surface of tail Ochraceous-Orange, with black around margin, and Warm Buff around outermost edge; antipalmar and antiplantar surfaces of feet Ochraceous-Buff; underparts creamy white with dark underfur. *Skull:* Large; braincase moderately inflated; zygomata strong. *Baculum:* As in *E. u. umbrinus.*

Comparisons.—From *E. u. umbrinus,* the subspecies from the Uinta and northern Wasatch Mountains of Utah, *E. u. sedulus* differs in: General tone of upper parts lighter; sides lighter.

From *E. u. adsitus,* the subspecies from the southern Wasatch Range in Utah and Kaibab Plateau in Arizona, *E. u. sedulus* differs in: Sides lighter; general tone of upper parts markedly lighter.

From *E. u. inyoensis,* the subspecies from central and northeastern Nevada, and western and northwestern Utah, *E. u. sedulus* differs in: Sides lighter (less grayish); general tone of upper parts tawnier.

For comparison with *E. u. montanus,* see the account of that subspecies.

Specimens examined.—Total number, 7 BS, all from the type locality.

Eutamias umbrinus inyoensis Merriam

Eutamias speciosus inyoensis Merriam, Proc. Biol. Soc. Washington, 11:202, 208, July 1, 1897.

Type.—Male, adult, skull and skin, No. 29387/41462 U. S. Nat. Mus. Biol. Surv. Coll.; from Black Canyon, 8,200 ft., White Mountains, Inyo County, California; obtained on July 7, 1891, by E. W. Nelson; original No. 1069.

Diagnosis.—Size medium; sides light; general tone of upper parts light; baculum one of largest in species.

Description.—Color pattern: Head Smoke Gray mixed with Pink-Cinnamon; upper two pairs of facial stripes Fuscous Black or black; submalar stripe Sayal Brown; ear Fuscous or Chaetura-Drab, posterior margin and postauricular patch buffy white; median dorsal dark stripe black with Sayal Brown along

margins; lateral dorsal dark stripes black mixed with Sayal Brown or Mikado Brown; outermost dorsal dark stripes Sayal Brown or Mikado Brown mixed with black; sides Ochraceous-Tawny or Tawny; thighs Cinnamon-Buff mixed with Smoke Gray; antipalmar and antiplantar surfaces of feet Cinnamon-Buff; ventral surface of tail Cinnamon-Buff or Ochraceous-Tawny with Fuscous Black around margin and Pinkish Buff around outermost edge; underparts creamy white. *Skull:* Large; zygomata strong; braincase moderately inflated. *Baculum:* One of largest in species.

Comparisons.—For comparisons with *E. u. umbrinus, E. u. adsitus, E. u. sedulus,* and *E. u. nevadensis,* see the accounts of those subspecies.

Remarks.—The baculum in *E. u. inyoensis* is like that in *E. palmeri.*

Specimens examined.—Total number, 46.

Nevada: *Elko Co.:* Head Ackler Creek, N end Ruby Mountains, 1; Steels Creek, N end Ruby Mountains, 1; Summit Secret Pass, 6,200 ft., Ruby Mountains, 2; Three Lakes, Ruby Mountains, 11; Long Creek, S fork, Ruby Mountains, 4; Harrison Pass R. S., Green Mountain Canyon, 1; W side Ruby Lake, 6 mi. N Elko Co. line, 3; W side Ruby Lake, 3 mi. N Elko Co. line, 8. *White Pine Co.:* Willow Creek, 2 mi. S White Pine Co. line, Ruby Mountains, 6; W side Ruby Lake, 3 mi. S White Pine Co. line, 5; Overland Pass, E slope Ruby Mountains, 8 mi. S White Pine Co. line, 2.

Utah: *Boxelder Co.:* Head of George Creek and Clear Creek, 5 mi. S Stanrod, Raft River Mountains, 8,500 ft., 2 UU.

Eutamias umbrinus nevadensis Burt

Eutamias quadrivittatus nevadensis Burt, Jour. Mamm. 12:299, August 24, 1931.

Type.—Male, adult, skull and skin, No. 15884 Donald R. Dickey Collection; from Hidden Forest, Sheep Mountains, 8,500 ft., Clark County, Nevada; obtained on July 13, 1929, by W. H. Burt; original No. 2337.

Diagnosis.—Size medium; general tone of upper parts grayish; baculum one of the largest of species.

Description.—"General tone of upperparts grayish; median dorsal stripe, extending from crown between ears to rump, black faintly bordered with 'verona brown'; lateral dark dorsal stripes similar to median stripe, but with anterior one-third deeply suffused with 'verona brown'; central light dorsal stripes grayish, slightly lighter than head and rump; lateral stripes white; head and rump 'pale smoke gray'; postauricular patch grayish white, a narrow margin extending up posterior border of ear; anterior portion of ear 'fuscous black' mixed with 'verona brown' at base and bordered by light gray; ocular stripe black grading into 'verona brown' in front of ear; submalar stripe nearly obsolete, 'sayal brown'; sides of body grayish washed with 'verona brown'; feet grayish very faintly washed with 'pinkish buff'; dorsal surface of tail black overlaid with 'tilleul buff'; ventral surface of tail 'cinnamon buff' narrowly bordered by black then by 'tilleul buff'; ventral surface of body white." (Burt 1931:299.) Skull similar to that of *E. u. inyoensis* but differing as indicated below.

Comparisons.—From *E. u. inyoensis,* the subspecies to the north, *E. u. nevadensis* differs in: Paler and grayer throughout; tawny areas restricted; gray areas clearer and less suffused; dark facial markings narrower and less

distinct; ventral surface of tail distinctly paler; feet lighter, clearer gray; nasals extend farther posteriorly with respect to premaxillae (Burt *loc. cit.*).

From *E. u. adsitus,* the subspecies to the northeast, *E. u. nevadensis* differs in: Narrower dorsal stripes and facial markings; paler coloration of head, rump, sides, feet, and ventral surface of tail (Burt *op. cit.:* 299-300).

Remarks.—The differences between *E. umbrinus nevadensis* and *E. palmeri*, as shown by Burt (*op. cit.*) and Hall (1946), are such that one might expect *E. palmeri* to be a subspecies of *E. umbrinus.* However, having only the structure of the baculum as evidence additional to that summarized by Hall (*op. cit.*), I follow him in according *E. palmeri* specific status.

Specimens examined.—None.

Eutamias umbrinus fremonti new subspecies

Type.—Male, adult, skull, skin, and baculum, No. 41790 Univ. Kansas Mus. Nat. Hist.; from 31 mi. N Pinedale, 8,025 ft., Sublette County, Wyoming; obtained on July 8, 1951, by Rollin H. Baker; original No. 1596.

Diagnosis.—Size large; sides Capucine Yellow; antiplantar surface of hind feet Raw Sienna; postauricular patch grayish white; baculum as in *E. u. umbrinus.*

Description.—Color pattern: Crown Cinnamon-Buff mixed with gray; upper facial stripe Sepia; ocular stripe Chaetura-Drab; submalar stripe Fuscous Black mixed with Sayal Brown; ear black; anterior margin of ear Mars-Yellow, posterior margin grayish white; hairs inside posterior portion of pinna Dresden-Brown; postauricular patch Pale Smoke Gray; median dorsal dark stripe black; lateral dorsal dark stripe black mixed with Sayal Brown; outermost dorsal dark stripe obsolete, Buckhorn-Brown mixed with black; median pair of dorsal light stripes grayish mixed with Buckhorn-Brown; outer pair of dorsal light stripes creamy white; sides Buckhorn-Brown; rump Pale Smoke Gray mixed with Saccardo's Umber; dorsal surface of tail black mixed with Buckhorn-Brown; ventral surface of tail Sayal Brown; outermost edge of tail Light Buff; antipalmar surface of forefeet Warm Buff; antiplantar surface of hind foot Ochraceous-Tawny; underparts creamy white with dark underfur. *Skull:* Large, with strong zygomata; braincase well inflated. *Baculum:* As in *E. u. umbrinus.*

Comparisons.—From *E. u. umbrinus,* the subspecies from the Uinta and northern Wasatch Mountains in Utah, *E. u. fremonti* differs in: Sides darker; antiplantar surfaces of feet darker; postauricular patch grayer; crown more grayish; skull slightly larger.

From *E. ruficaudus ruficaudus,* the species and subspecies from western Montana, *E. u. fremonti* differs in: General tone of upper parts, sides, underside of tail, and feet, all darker in coloration; baculum shorter and proportionally twice as wide at base.

For comparison with *E. u. montanus,* see the account of that subspecies.

Remarks.—The geographic ranges of *E. umbrinus fremonti* and *E. ruficaudus ruficaudus* are allopatric and no specimens have ever been taken in the intermediate area to indicate whether or not

these two species anywhere occur together. The bacula in the two species differ to the same degree as those of *E. quadrivittatus* and *E. umbrinus*. The differences between *E. u. fremonti* and *E. r. ruficaudus* are such that in my opinion, *E. ruficaudus* is a distinct species.

Specimens examined.—Total number, 58.

Montana: *Park Co.:* Beartooth Mountains, 2 BS.

Idaho: *Bonneville Co.:* Big Hole Mountains, 9,000 ft., near Irwin, 1 BS.

Wyoming: *Yellowstone Park,* 2. *Park Co.:* 16¾ mi. N and 17 mi. W Cody, 5,625 ft., 2. *Teton Co.:* 1 mi. E and ¼ mi. N Togwotee Pass, 9,800 ft., 2; Amphitheatre Lake, Teton Park, 1 MM; Flat Creek, 4 MM; head of Cache Creek, 4 MM; Jackson, Upper Arizona Creek, 2 MM; Flat Creek-Granite Creek divide, 6 MM; Flat Creek Pass, 1 MM; Flat Creek-Gravel Creek divide, 2 MM. *Lincoln Co.:* La Barge Creek, 9,000 ft., 2 BS. *Fremont Co.:* Togwotee Pass, 12; 12 mi. N and 3 mi. W Shoshoni, 4,650 ft., 1; Mosquito Park R. S., 9,500 ft., 17½ mi. W and 2½ mi. N Lander, 1; 17 mi. S and 6½ mi. W Lander, 8,450 ft., 3. *Sublette Co.:* 31 mi. N Pinedale, 8,025 ft., 2; W side Barbara Lake, 10,300 ft., 8 mi. S and 3 mi. W Fremont Peak, 4; 19 mi. W and 2 mi. S Big Piney, 7,700 ft., 5.

Eutamias umbrinus montanus new subspecies

Type.—Male, adult, skull, skin, and baculum, No. 20105 Univ. Kansas Mus. Nat. Hist.; from ½ mi. E and 3 mi. S Ward, 9,400 ft., Boulder County, Colorado; obtained on August 1, 1947, by E. L. Cockrum; original No. 721.

Diagnosis.—Size large; sides Clay Color; antipalmar and antiplantar surfaces of feet Cinnamon-Buff; baculum as in *E. u. umbrinus.*

Description.—Color pattern: Crown Raw Sienna mixed with gray; upper facial stripe and ocular stripe black mixed with Sepia; submalar stripe Snuff Brown mixed with black; ear black or Sepia, anterior margin Ochraceous-Tawny, posterior margin and postauricular patch grayish white; hairs inside posterior part of pinna Cinnamon-Buff; median dorsal dark stripe black with Sayal Brown along margins; lateral dark stripes black mixed with Sayal Brown; outermost dorsal dark stripes obsolete, Sayal Brown mixed with black; median pair of dorsal light stripes Pale Smoke Gray mixed with Clay Color; outer pair of dorsal light stripes creamy white; sides Clay Color; rump and thighs Neutral Gray; dorsal surface of tail black mixed with Cinnamon-Buff; ventral surface of tail Ochraceous-Tawny; hairs around margin of tail Cinnamon-Buff or Ochraceous-Tawny; antipalmar and antiplantar surfaces of feet Cinnamon-Buff; underparts creamy white with dark underfur. *Skull:* Large; zygomata strong; braincase well inflated. *Baculum:* As in *E. u. umbrinus.*

Comparisons.—From *E. quadrivittatus quadrivittatus,* the subspecies and species to the south, *E. u. montanus* differs in: General tone of upper parts darker; braincase significantly narrower; baculum shorter and markedly wider at base.

From *E. u. umbrinus,* the subspecies from the Uinta and northern Wasatch Mountains, *E. u. montanus* differs in: General tone of upper parts brighter (less tawny); sides more tawny; skull slightly larger.

From *E. u. sedulus,* the subspecies from the Henry Mountains of Utah, *E. u. montanus* differs in: Sides darker; general tone of upper parts darker.

From *E. u. fremonti,* the subspecies from the mountains of western and northwestern Wyoming, *E. u. montanus* differs in: General tone of upper parts lighter; hairs around outermost edge of tail tawnier.

Remarks.—Howell (1929:83) stated that the specimens of *E. quadrivittatus quadrivittatus* (= *E. umbrinus montanus*) from Estes Park, Long's Peak, and Gold Hill, all in Colorado, "average somewhat darker on the back and sides than typical *quadrivittatus;* the light dorsal stripes are also somewhat duller and the dark stripes less blackish, thus showing an approach to the characters of *umbrinus.*" Now there are more specimens of *E. u. montanus* from the mountains of north-central Colorado than were available to Howell. He was not aware of the striking difference between the bacula of *E. quadrivittatus* and *E. umbrinus,* and the constancy of this difference between all the subspecies of one species and those of the other.

Although the geographic range of *E. u. umbrinus* is closer to the ranges of *E. u. fremonti* and *E. u. montanus* than to the geographic range of *E. u. adsitus, E. u. umbrinus* seems to be more closely related to *E. u. adsitus* than to *E. u. fremonti* or *E. u. montanus.* This observation may be explained by the presence of continuous habitat for *E. umbrinus* between the ranges of *E. u. umbrinus* and *E. u. adsitus,* whereas *E. u. fremonti* and *E. u. montanus* are each separated from *E. u. umbrinus* by areas unsuitable for occupancy by *E. umbrinus.* It must be noted, however, that no actual intergrades between *E. u. umbrinus* and *E. u. adsitus* are known.

Specimens examined.—Total number, 36.

Wyoming: *Albany Co.:* 3 mi. ESE Brown's Peak, 10,000 ft., 2; 3½ mi. S Wood's Landing, 1.

Utah: *Uintah Co.:* PR Springs, 7,950 ft., 43 mi. S Ouray, Uintah-Grand county line, 1 UU.

Colorado: *Jackson Co.:* Mount Zirkel, 10,000 ft., on trail, 2 WC; Buffalo Pass, 10,380 ft., 1 WC; Buffalo Pass road, 10,130 ft., 1 WC. *Larimer Co.:* 2 mi. E Log Cabin, 7,450 ft., 1 WC; Estes Park, 7,600 ft., 1; 1½ mi. SW Estes Park, 1; 2½ mi. SW Estes Park, 2; 3½ mi. SW Estes Park, 1; 12 mi. SW Estes Park, 1. *Rio Blanco Co.:* 1 mi. NW Pagoda Peak, 10,400 ft., 1. *Boulder Co.:* Long's Peak, 7 BS; 1 mi. NE Ward, 10,000 ft., 1; 3 mi. S Ward, 9,000 ft., 5; ½ mi. E and 3 mi. S Ward, 9,400 ft., 1; 1 mi. S Gold Hill, 8,200 ft., 1. *Clear Creek Co.:* Davidson Mine, 3 mi. SW Idaho Springs, 1; Georgetown, 1 CM. *Jefferson Co.:* Silver Plume, 1 CM. *Park Co.:* Tarryall Creek Camp, 8,700 ft., 1 WC. *Gunnison Co.:* S side Crested Butte Mountain, 9,500 ft., 1 WC; mouth of Virginia Basin, Gothic, 1 FC.

Discussion

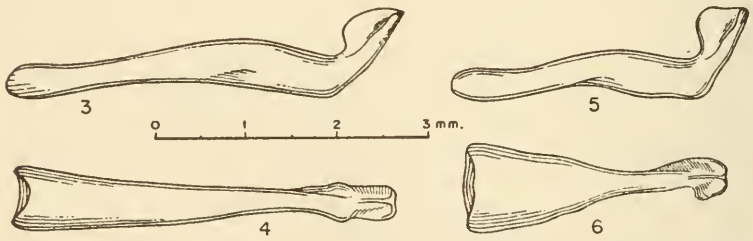
The chipmunks that heretofore have been assigned to the species *Eutamias quadrivittatus* are here assigned to two species, *E. quadrivittatus* and *E. umbrinus,* for the following reasons:

1. The baculum of *E. quadrivittatus* differs from that of *E. umbrinus* in having a narrow base (see figs. 3, 4). This difference permits any specimen which has an associated baculum to be readily identified to species.

2. The cranial breadth in the subspecies of *E. quadrivittatus* is significantly larger than in the subspecies of *E. umbrinus.*

3. Specimens of *E. umbrinus* are darker than any specimen of *E. quadrivittatus.*

4. Where the geographic ranges of *E. quadrivittatus* and *E. umbrinus* come close to one another (probably they meet at some places), *E. umbrinus* occupies a higher position in terms of life-zones. Wherever either of these two species, but not the other, occurs on a mountain the species occupies both the higher and lower life-zones.



Figs. 3 and 4. Baculum of *Eutamias quadrivittatus quadrivittatus,* No. 35648/47919 BS; from Canon City, Fremont Co., Colorado. Figure 3, lateral view of right side; figure 4, dorsal view.

Fig. 5. Baculum of *Eutamias umbrinus umbrinus,* No. 38062; from Paradise Park, 21 mi. W and 15 mi. N Vernal, 10,050 ft., Uintah Co., Utah. Lateral view of right side.

Fig. 6. Baculum of *Eutamias umbrinus montanus,* No. 20105; from ½ mi. E and 3 mi. S Ward, 9,400 ft., Boulder Co., Colorado. Dorsal view.

The differences between *E. quadrivittatus* and *E. umbrinus* are as great as, or greater than, between many species of chipmunks, such as between *E. minimus* and *E. amoenus,* and between *E. quadrivittatus* and *E. cinereicollis.*

Although I know of no ecological differences between *E. umbrinus* and *E. ruficaudus,* the morphological differences, as for example, differences in the structure of the baculum, and differences in color pattern, lead me to maintain *E. ruficaudus* and *E. umbrinus* as separate species.

The present distribution of these two species is attributable to the uplift of the Rocky Mountains in the Pleistocene. That the uplift of the Rocky Mountains and the erosion which produced the present-day relief took place in Pleistocene times is supported by the evidence found by several geologists such as Hunt and Sokoloff (1950:109-123).

The present geographic distribution of *E. umbrinus* and *E. quadrivittatus* conceivably came about as follows: *E. umbrinus*-like chipmunks were present, before the uplift of the major chains of mountains, on isolated, low mountain ranges that were not covered with glaciers (such as the laccolithic mountains that occur in Utah) in Pleistocene time, while *E. quadrivittatus*-like chipmunks were present in the central parts of New Mexico, Colorado, and southern Wyoming. With the advent of uplift, the habitats in the central parts of these states were changed from a plains-like habitat to a habitat that resembled the forest habitats that exist today. *E. umbrinus*-like chipmunks then invaded this newly formed habitat and displaced any *E. quadrivittatis*-like chipmunks that were less well adapted to live there. The Colorado River probably served as a barrier that kept the *E. umbrinus*-like chipmunks and *E. quadrivittatus*-like chipmunks separated up to this time. Invasion of the new forest-niche by *E. umbrinus*-like chipmunks may have taken place through the Uinta Mountains of northeastern Utah, after the glaciers disappeared from these mountains, since the Colorado River probably prevented any eastward migration farther south.

Table 1

Average and Extreme Measurements in Millimeters of Adult *Eutamias quadrivittatus* and *E. umbrinus*

	Greatest length of skull	Zygomatic breadth	Cranial breadth	Length of nasals	Total length	Length of tail	Length of lower tooth-row	Condylo-alveolar length of mandible
	E. q. quadrivittatus, Canon City, Fremont Co., Colorado.							
Mean..... (7)	35.7	19.3	16.2	11.0	222	99.4	5.40	18.98
Min..... ♂	35.7	19.1	15.9	10.6	216	93.0	5.32	18.65
Max.....	35.8	19.8	16.5	11.6	230	104.0	5.49	19.41
Mean..... (3)	35.9	19.9	16.5	10.9	231	99.0	5.42	19.10
Min..... ♀	35.6	19.9	16.5	10.7	200	98.0	5.39	18.85
Max.....	36.2	19.9	16.6	11.2	232	100.0	5.49	19.28
	E. q. hopiensis, Moab, Grand Co., Utah.							
Mean..... (11)	34.4	19.4	16.3	10.0	212	90.7	5.19	18.36
Min..... ♂	33.5	19.2	15.9	9.3	208	85.0	4.92	17.80
Max.....	35.4	20.0	16.8	10.5	220	96.0	5.38	18.96
Mean..... (5)	34.9	19.6	16.4	10.5	219	94.4	5.16	18.58
Min..... ♀	34.2	19.3	15.9	10.1	210	85.0	5.13	18.00
Max.....	35.7	20.1	16.6	10.7	228	104.0	5.20	19.19
	E. u. umbrinus, Mts. S Robertson, Uintah Co., Wyoming.							
Mean..... (11)	34.7	18.9	15.7	10.9	218	96.2	5.13	18.04
Min..... ♂	34.3	18.3	15.6	10.3	215	81.0	4.79	17.57
Max.....	35.2	19.4	16.0	11.7	228	112.0	5.42	18.59
Mean..... (4)	35.1	19.2	15.9	11.0	224	96.4	5.17	18.46
Min..... ♀	34.9	18.6	15.7	10.3	204	90.0	5.11	18.31
Max.....	35.4	20.0	16.2	11.8	234	100.0	5.22	18.98
	E. u. adsitus, Britts Meadow, Beaver Co., Utah.							
Mean..... (6)	34.8	18.9	15.5	10.8	214	89.6	5.16	18.07
Min..... ♂	34.3	18.5	15.3	10.4	203	73.0	4.64	17.69
Max.....	35.4	19.6	16.1	11.3	225	95.0	5.34	18.70
Mean..... (6)	35.1	19.5	16.0	11.0	228	96.5	5.11	18.75
Min..... ♀	33.9	18.9	15.9	10.6	215	95.0	5.00	18.51
Max.....	36.2	20.0	16.3	11.8	233	98.0	5.33	19.40

TABLE 1.—*Concluded*

	Greatest length of skull	Zygomatic breadth	Cranial breadth	Length of nasals	Total length	Length of tail	Length of lower tooth-row	Condylo-alveolar length of mandible
	E. u. sedulus, Mt. Ellen, Henry Mts., Garfield Co., Utah.							
Mean (5)	34.7	18.7	15.6	10.7	218	93.0	5.21	18.74
Min. ♂	33.5	18.4	15.4	10.1	213	89.0	5.09	18.48
Max.	35.5	19.1	15.9	11.2	224	97.0	5.28	19.38
Mean (2)	34.9	19.4	16.1	11.1	227	98.0	5.24	18.74
Min. ♀	34.9	19.3	16.1	11.0	224	96.0	5.07	19.24
Max.	34.9	19.5	16.1	11.3	231	100.0	5.42	19.80
	E. u. inyoensis, Ruby Mts., Elko and White Pine Cos., Nev.							
Mean (12)	34.4	19.0	15.7	10.5	208	89.5	5.15	18.12
Min. ♂	33.5	18.6	15.2	10.0	196	85.0	5.01	17.32
Max.	35.4	19.6	16.1	11.5	220	100.0	5.37	18.81
Mean (5)	34.9	19.4	15.7	10.5	215	92.8	5.19	18.63
Min. ♀	34.4	19.1	15.4	10.4	204	86.0	5.04	18.50
Max.	35.2	19.7	16.0	10.7	226	102.0	5.33	18.80
	E. u. nevadensis, Measurements of the type (Burt 1931:300).							
♂	34.8	19.3	16.2	11.0	205	89.0	.....	.....
	E. u. fremonti, Togwotee Pass, Fremont Co., Wyoming.							
Mean (8)	35.6	19.3	15.9	11.4	223	99.0	5.34	19.17
Min. ♂	35.2	18.9	15.8	11.1	216	95.0	5.22	18.72
Max.	36.5	19.7	16.1	11.8	243	111.0	5.57	19.78
Mean (6)	35.3	19.6	15.9	11.3	229	101.0	5.40	19.02
Min. ♀	34.5	19.3	15.7	10.9	223	92.0	5.35	18.37
Max.	36.0	20.0	16.5	12.0	239	110.0	5.44	19.51
	E. u. montanus, Boulder Co., Colorado.							
Mean (5)	35.2	18.8	15.5	10.8	226	96.0	5.20	18.29
Min. ♂	34.7	18.4	15.2	10.1	215	93.0	5.03	17.80
Max.	36.8	19.4	16.2	11.5	232	115.0	5.53	19.36
Mean (6)	35.7	19.1	15.6	10.9	226	98.0	5.28	18.67
Min. ♀	35.1	18.8	15.1	10.3	215	89.0	5.06	18.09
Max.	36.5	19.5	16.0	11.6	231	105.0	5.58	19.35

Literature Cited

Benson, S. B.
1935. A biological reconnaissance of Navajo Mountain, Utah. Univ. California Publ. Zool., 40:439-455, December 31.

Burt, W. H.
1931. Three new subspecies of chipmunks of the genus Eutamias from Nevada. Jour. Mamm., 12:298-301, August 24.

Durrant, S. D.
1952. Mammals of Utah, taxonomy and distribution. Univ. Kansas Publ. Mus. Nat. Hist., 6:1-549, 91 figs., 30 tables, August 10.

Hall, E. R.
1946. Mammals of Nevada. Univ. California Press, Berkeley, California, pp. xi + 710, 11 pls., 485 figs., July 1.

Hardy, R.
1945. The taxonomic status of some chipmunks of the genus Eutamias in southwestern Utah. Proc. Biol. Soc. Washington, 58:85-87, June 30.

Howell, A. H.
1929. Revision of the American chipmunks (genera *Tamias* and *Eutamias*). U. S. Dept. Agric., Bur. Biol. Surv., N. Amer. Fauna, 52:1-157, 10 pls., 9 figs., November 30.

Hunt, C. B., and Sokoloff, V. P.
1950. Pre-Wisconsin soil in the Rocky Mountain region, a progress report. U. S. Geol. Survey, Prof. Paper, 221-G:109-123.

Johnson, D. H.
1943. Systematic review of the chipmunks (genus Eutamias) of California. Univ. California Publ. Zool., 48:63-148, 6 pls., December 24.

Kelson, K. R.
1951. Speciation in rodents of the Colorado River drainage. Univ. Utah Biol. Ser., 11(3): vii + 125, 10 figs., February 15.

Merriam, C. H.
1905. Two new chipmunks from Colorado and Arizona. Proc. Biol. Soc. Washington, 18:163-166, June 29.

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Geographic Distribution and Taxonomy of the Chipmunks of Wyoming

BY

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Purpose

The purpose of the following account is to: (1) Show what kinds of chipmunks occur in Wyoming; (2) point out the interrelationships between these kinds; and (3) account, where possible, for the present distribution of these animals in Wyoming.

Methods, Materials, and Acknowledgments

Capitalized color terms in the following accounts are of Ridgway, "Color Standards and Color Nomenclature," Washington, D. C., 1912.

The measurements of the skull that were used in this study were made as shown in White (1953:566, fig. 1). These are: Greatest length of skull, zygomatic breadth, cranial breadth, length of nasals, length of lower tooth-row, condylo-alveolar length of mandible, and inner mandibular length.

Of the external measurements, only the total length and the length of the tail are recorded in table 1. Some field collectors measured the ear from the notch and others from the crown; most collectors measured the length of the hindfoot to the nearest millimeter rather than in tenths of a millimeter as would have been desirable. Consequently, I decided against using the length of the ear and hindfoot in this report.

When the word "significantly" is used in comparisons, it is meant to show that there is a significant statistical difference between two or more samples. Whenever eight or more specimens from one locality were available, the mean, range, standard deviation, standard error of the mean, and coefficient of variability were calculated.

Only adult specimens were used in comparison. "Aging" of specimens is discussed on page 587 of this paper.

The geographic range of each species and subspecies is not described in writing, for, the localities are plotted on maps along with the geographic range of each subspecies, and under "specimens examined" the locality of each specimen or series of specimens is listed.

In the synonymy of each subspecies there appears, first the first usage of a name, second the first usage of the name combination now employed, and third, pure synonyms.

A total of 757 specimens of chipmunks are listed as examined in the course of preparing this report. Additional specimens were less carefully examined in the Biological Surveys Collection in Washington, D. C. Specimens used in my study, unless otherwise specified, are in the Museum of Natural History, University of Kansas. The symbols representing the collections containing specimens studied are as follows:

BS—United States Biological Surveys Collection.
FC—Collection of James S. Findley.
MM—Museum of Zoology, University of Michigan.
NM—United States National Museum.
KU—Museum of Natural History, University of Kansas.

I am grateful to Professor E. Raymond Hall for guidance in my study and thank Doctors Robert W. Wilson, E. Lendell Cockrum, Keith R. Kelson, A. Byron Leonard, Rollin H. Baker, and others at the Museum of Natural History and Department of Zoology, University of Kansas, for encouragement and

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For permission to borrow and to study specimens, I thank Dr. W. H. Burt of the Museum of Zoology, University of Michigan, Miss Viola S. Schantz of the United States Fish and Wildlife Service, Mr. Colin C. Sanborn of the Chicago Natural History Museum, and Mr. James S. Findley.

Assistance with field work is acknowledged from the Kansas University Endowment Association, the National Science Foundation and the United States Navy, Office of Naval Research, through contract No. NR161 791.

VARIATION

Secondary sexual variation in chipmunks is small; the females are slightly larger than the males. This difference in size is so slight that it can be ignored when making taxonomic comparisons, for, large samples of males and females of like age and from the same locality were compared and were found statistically not to be significantly different. This is in agreement with Johnson (1943:70) and Hall (1946:329).

Variations of taxonomic worth are treated in the accounts of species and subspecies.

Individual variation is slight, for, the analyses of measurements of the skulls of series of specimens of like age, reveal markedly low coefficients of variability resembling those published by Larrison (1949).

The age-categories here recognized are based primarily on the structure of the skull.

Juveniles.—Nasals proportionally shorter and more pointed anteriorly than in other categories; zygomatic arches more appressed to cranium; suture separating basisphenoid and presphenoid noticeably "open"; deciduous P4 and p4 show no wear through enamel; M3 and m3 not yet erupted; peglike deciduous P3 strongly leaning posteriorly; molars show no wear through enamel; parietals paperlike or thin; skull convex dorsally; 1 to 1½ months of age.

Young.—Nasals of adult proportions; zygomatic arches still noticeably appressed anteriorly to cranium; suture between basisphenoid and presphenoid still "open"; nasals rounded, no longer so pointed as in juveniles; deciduous P4 and p4 show wear through enamel layer, and in some specimens, permanent P4 and p4 can be seen beneath; roots of deciduous P4 and p4 clearly show erosion beneath; M3 and m3 fully erupted; peglike deciduous P3 still present; parietals noticeably thicker and less paperlike; skull flattened (not so convex dorsally), but not so flattened as in adults; 1½ to 4 months of age.

In both juveniles and young the P4 and p4 are deciduous and differ in occlusal pattern from the permanent P4 and p4. In the deciduous P4 the anterior cingulum is projected strongly anteriorly forming the apex of the sharpest angle of a triangle, whereas the permanent P4 is trapezoidal in occlusal pattern. In the deciduous p4 the protoconid and metaconid are close together giving this tooth a triangular appearance in occlusal pattern, whereas this pattern in permanent p4 is trapezoidal (see Hall 1926:390).

Subadults.—Adult configuration of skull reached; suture between basisphenoid and presphenoid completely closed; nasals rounded anteriorly; permanent P4 and p4 show no wear through enamel layer; wear through enamel layer of molars noticeable, especially through protocones; peglike permanent P3 slanting only slightly posteriorly; skull only slightly convex dorsally; parietals solid and resistant to pressure; lambdoidal crest weakly developed; 4 to 10 months of age.

Adults.—Lambdoidal crest well developed; supraorbital ridges pronounced; P4 and p4 show wear through enamel layer and frequently as worn as molars; noticeable wear on lophs and lophids of molars; occlusal pattern always visible; ten months to 2 years of age.

Old adults.—Ridges and crests extremely well developed; occlusal pattern of molariform teeth obliterated or nearly so; P3 noticeably worn; 2 to 4 years or older.

The hypohyal and ceratohyal bones of the hyoid apparatus are distinct from one another in juveniles and young, but are fused in subadults, adults, and old adults.

Lack of suitable material prevented me from studying chipmunks younger than juveniles. The patterns of growth of these younger chipmunks probably closely follow the changes described by Hall (1926) for *Citellus beecheyi.*

The tip of the baculum in juveniles and young is proportionally longer, in relation to the shaft, than in subadults, adults, and old adults.

Juvenal (juveniles and young) pelage in chipmunks is characterized by silkiness and sparseness, especially on the venter. The coloration of this juvenal pelage resembles that of adults in winter pelage which is duller than adult summer pelage. Adult pelage (subadults, adults, and old adults) is not so silky as juvenal pelage, but there are more hairs, especially on the venter. The color pattern is the same in both juvenal and adult pelages.

Chipmunks are born naked and blind and in about two weeks the "body is covered with silken hair clearly demonstrating the color pattern so characteristic of chipmunks . . ." (Shaw 1944:282). This "silken hair" is replaced by adult summer pelage, and juvenal chipmunks which are molting into adult summer pelage closely resemble the adult males, and later on in the summer, the adult females. Adult females molt later, as a rule, than adult males probably because of lactation. Summer molt begins, on chipmunks in Wyoming and South Dakota, in the latter part of June and is completed by the latter part of August or the first part of September.

Summer molt begins, topographically, in the region of the head and progresses posteriorly to the base of the tail, for, the tail does not molt into summer pelage. The winter molt starts at the same time at the tip of the tail and at the base of the tail, and from each place proceeds anteriorly. The sequence described above is the rule; exceptionally, there are some specimens which molted in patches. In most skins, molts are easily detected because distinct molt-lines were formed. The above description of molting is based on study of a large series of specimens of *Eutamias minimus silvaticus* taken in several seasons of the year.

The summer pelage is bright, more especially on the sides. In late summer the pelage on the tail is markedly worn, and the hairs around its outer margin are broken. In texture, the summer pelage is not so soft as winter pelage, and this is probably owing to the presence of large amounts of "kinky" underfur in the winter pelage.

The winter pelage is soft, dull in color, and gives the specimen a grayish or an umbrous appearance. The guard hairs are longer than in the summer pelage.

KEY TO THE SPECIES OF THE CHIPMUNKS OF WYOMING

1. Dorsal stripes faint; general tone of upper parts grayish.
   Eutamias dorsalis, p. 603
1′. Dorsal stripes distinct; general tone of upper parts tawny (not grayish).
   2. Venter yellowish or buff; tip of baculum more than 30 per cent of length of shaft; shaft of baculum not widened at base.
      Eutamias amoenus, p. 602
   2′. Venter white; tip of baculum less than 29 per cent of length of shaft —if more than 29 per cent, shaft widened at base.
      3. Size small to medium; greatest length of skull less than 34 mm.; shaft of baculum not widened at base; outermost dorsal dark stripe never obsolete. . . . . *Eutamias minimus*, p. 590
      3′. Size large; greatest length of skull rarely less than 34 mm.; shaft of baculum widened at base; outermost dorsal dark stripe often obsolete, never strongly evident. . . . . *Eutamias umbrinus*, p. 606

Accounts of Species and Subspecies

Eutamias minimus (Bachman)

Diagnosis.—Size small; tip of baculum of adults less than 28 per cent of length of shaft; outermost dorsal dark stripes distinct; skull small to medium; when skull medium, zygomatic breadth not proportionally narrower.

Comparisons.—From *Eutamias amoenus luteiventris,* the only subspecies of that species in Wyoming, *E. minimus* differs in: Size smaller; tip of baculum in adults less than 28 per cent of length of shaft; zygomatic arches proportionally wider; underparts white or with less yellow or tawny.

From *E. umbrinus, E. minimus* differs in: Size smaller; general tone of upper parts lighter; base of baculum not widened but almost as narrow as least diameter of shaft.

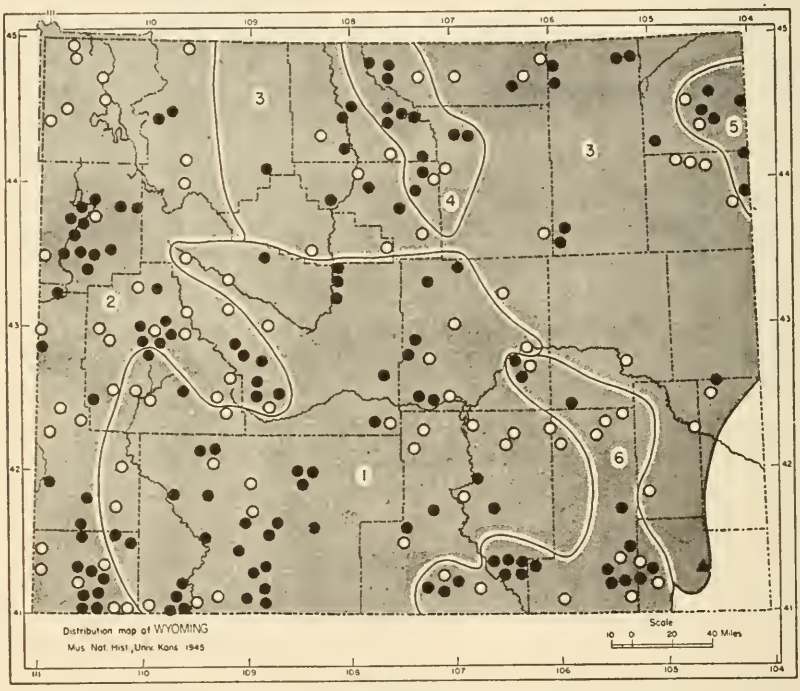

Fig. 1. Known occurrence and probable geographic distribution of the subspecies of *Eutamias minimus* in Wyoming. The symbols for locality records are as follows: Circles, specimens reported but not examined; solid circles, precise localities of specimens examined; solid triangles, localities of specimens examined, known only to county.

1. *E. m. minimus*
2. *E. m. consobrinus*
3. *E. m. pallidus*
4. *E. m. confinis*
5. *E. m. silvaticus*
6. *E. m. operarius*

From *E. dorsalis utahensis,* the only subspecies of this species in Wyoming, *E. minimus* differs in: Dorsal dark stripes distinct and usually blackish; skull smaller; tip of baculum of adults less than 28 per cent of length of shaft.

Remarks.—This is the smallest of the species of chipmunks in Wyoming, and in the state can be readily distinguished from the other species by the smaller size and by the characteristic proportions of the baculum.

E. minimus occurs in all the Life-zones of Wyoming, and inhabits open country, such as in the great expanses where sagebrush (*Artemesia* sp.) is predominant, or inhabits the edges of forests, never occurring in the forest proper.

Analyses of measurements of the skull indicate that of the six subspecies of *E. minimus* that are found in Wyoming, two are small (*E. m. minimus* and *E. m. consobrinus*) and the other four are large (*E. m. pallidus, E. m. confinis, E. m. silvaticus,* and *E. m. operarius*). Within these size-groups the subspecies can be distinguished by differences in color pattern.

Eutamias minimus minimus (Bachman)

Tamias minimus Bachman, Jour. Acad. Nat. Sci. Philadelphia, 8(pt.1):71, 1839.

Eutamias minimus, Miller and Rehn, Proc. Boston Soc. Nat. Hist., 30:42, December 27, 1901.

Type.—Obtained on Green River, near mouth of Big Sandy Creek, Sweetwater County, Wyoming. Age, sex, collector, and date when obtained, not surely known.

Diagnosis.—Size small; general tone of upper parts pale grayish brown; baculum small.

Description.—Color pattern: Crown Pinkish Buff mixed with grayish white; facial stripes Snuff-Brown mixed with black; anterior margin of ear Drab washed with Cinnamon; hairs inside posterior part of pinna Light Pinkish Cinnamon; posterior margin of ear and postauricular patch grayish white; median dorsal dark stripe black with Sayal Brown along margins; lateral pair of dark stripes Sayal Brown more or less mixed with Fuscous; pairs of light dorsal stripes grayish white and tinged with Buff; rump and thighs Smoke Gray; dorsal surface of tail Fuscous Black mixed with Cinnamon-Buff; ventral surface of tail Sayal Brown or Clay Color, Blackish Brown mixed with Cinnamon-Buff around margins; antiplantar and antipalmar surfaces of feet Pale Pinkish Buff; underparts creamy white. *Skull* and *Baculum:* Small but proportionally the same as in other subspecies of *E. minimus.*

Comparisons.—From *E. m. consobrinus,* the subspecies to the west and south, *E. m. minimus* differs in: Over-all tone of upper parts lighter; underside of tail lighter.

From *E. m. pallidus,* the subspecies to the north and northeast, *E. m. minimus* differs in: Size smaller; skull shorter and narrower; mandible shorter and shallower; baculum shorter; slightly paler.

From *E. m. confinis,* the subspecies in the Big Horn Mountains, *E. m. minimus* differs in: Size smaller; skull shorter and narrower; mandible shorter and shallower; baculum shorter; paler.

From *E. m. operarius,* the subspecies to the east and southeast, *E. m. minimus* differs in: Size smaller; skull shorter and narrower; mandible shorter and shallower; baculum shorter; paler.

Remarks.—*E. m. minimus* is the smallest of the chipmunks that occur in Wyoming. This pale little squirrel is found in the Red Desert in Sweetwater County, where the features distinctive of the subspecies are most strongly developed. Specimens from western Sweetwater County and northwestern Uinta County are intergrades between *E. m. minimus* and *E. m. consobrinus* and are referable to *E. m. minimus.*

Specimens examined.—Total number 167.

Sublette Co.: 60 mi. SE Jackson [Teton County], 1 (MM); 2 mi. SE Big Sandy, 1.

Fremont Co.: 40 mi. E Dubois, 1; 12 mi. N and 3 mi. W Shoshoni, 4,650 ft., 2; 9 mi. N and 3 mi. E Shoshoni, 4,700 ft., 2; 7 mi. N and 3 mi. E Shoshoni, 4,700 ft., 3; 2½ mi. W Shoshoni, 4,800 ft., 1; Granite Mountains, 6; Mount Crooks, 8,600 ft., 6.

Natrona Co.: 27 mi. N and 1 mi. E Powder River, 6,075 ft., 2; 15 mi. N and 1 mi. W Waltman, 1; 9 mi. S and 9 mi. W Waltman, 6,950 ft., 1; 16 mi. S and 11 mi. W Waltman, 6,950 ft., 2; Sun Ranch, 5 mi. W Independence Rock, 6,000 ft., 4; 9 mi. W and 1 mi. N Independence Rock, 1; 5 mi. W and 1 mi. S Independence Rock, 2.

Uinta Co.: 15 mi. WSW Granger [Sweetwater County], 1; 10 mi. SW Granger [Sweetwater County], 10 (MM).

Sweetwater Co.: Farson, 6,580 ft., 11; 5 mi. E Farson, 1; 27 mi. N Table Rock, 1 (MM); 27 mi. N and 37 mi. E Rock Springs, 6,700 ft., 1; 25 mi. N and 38 mi. E Rock Springs, 6,700 ft., 3; Junction of Big Sandy Creek and Green River, 6,400 ft., 7 (3MM); 17 mi. N and 6 mi. W Rock Springs, 7,000 ft., 1; Thayer Junction, 9 (MM); Table Rock, 1 (MM); Wamsutter, 1 (MM); Green River, 4 (MM); Bitter Creek, 2 (FC); 13 mi. S and 14 mi. E Rock Springs, 6,650 ft., 2; 18 mi. S Bitter Creek, 6,800 ft., 2; 22 mi. SSW Bitter Creek, 5; 26 mi. S and 21 mi. W Rock Springs, 3; Kinney Ranch, 6,800 ft., 21 mi. S Bitter Creek, 15; 30 mi. S Bitter Creek, 2; 32 mi. S and 22 mi. W Rock Springs, 1; 32 mi. S and 22 mi. E Rock Springs, 7,025 ft., 12; 33 mi. S Bitter Creek, 6,900 ft., 6; 3 mi. W Green River, and 2 mi. N Utah Boundary, 1; ½ mi. N Junction Henrys Fork and Utah Boundary, 2; 1 mi. N Linwood, Utah, 1 (MM).

Carbon Co.: 18 mi. NNE Sinclair, 6,500 ft., 2; Rawlins, 1; 30 mi. E Rawlins, 6,750 ft., 2; Bridgers Pass, 18 mi. SW Rawlins, 7,500 ft., 1.

Additional records (Howell 1929:38): *Lincoln Co.:* Fontanelle; Opal. *Sublette Co.:* Big Piney; Green River at junction with New Fork; Muddy Creek, near Big Sandy Creek. *Fremont Co.:* Jackeys Creek, 3 mi. S Dubois; Wind River near mouth of Meadow Creek; Ft. Washakie; Green Mountains, 8 mi. E Rongis. *Natrona Co.:* Bitter Creek, near Powder River; Rattlesnake Mountains; Casper; Independence Rock. *Sweetwater Co.:* Eden, Steamboat Mountain; Superior; Maxon; Green River, 4 mi. N Linwood, Utah; Henrys Fork, at mouth of Burnt Fork. *Carbon Co.:* Canyon Creek, 12 mi. S Alcova; Ferris Mountains; Shirley; Shirley Mountains; 8½ mi. SE Lost Soldier [= Bairoil]; Ft. Steele; Sulphur Springs. *Albany Co.:* Spring Creek, 10 mi. W Marshall; Sheep Creek. *County uncertain:* Little Sandy River; Green River.

Eutamias minimus consobrinus (J. A. Allen)

Tamias minimus consobrinus J. A. Allen, Bull. Amer. Mus. Nat. Hist. 3:112, June, 1890.
Eutamias minimus consobrinus, Miller and Rehn, Proc. Boston Soc. Nat. Hist. 30:42, December 27, 1901.
Eutamias lectus J. A. Allen, Brooklyn Inst. Mus. Sci. Bull. 1:117, March 31, 1905 (not in Wyoming), type from Beaver Valley, Utah.
Eutamias consobrinus clarus Bailey, Proc. Biol. Soc. Washington, 31:31, May 16, 1918, type from Swan Lake Valley, Yellowstone National Park, Wyoming.

Type.—Male, adult, skull and skin, No. 186456 (NM); from near Barclay, Parley's Canyon, Wasatch Mountains, Salt Lake County, Utah; obtained on October 31, 1888, by Vernon Bailey; original No. 361.

Diagnosis.—Size small; over-all tone of upper parts grayish brown; baculum small, as in *E. m. minimus.*

Description.—Color pattern: Crown Smoke Gray mixed with Ochraceous-Tawny; upper facial stripe Fuscous; other facial stripes Fuscous or Fuscous Black mixed with Tawny; hairs inside posterior part of pinna Light Ochraceous-Buff; anterior margin of ear Ochraceous-Tawny; posterior margin of ear and postauricular patch grayish white; median dorsal dark stripe black with Ochraceous-Tawny along margins; other dorsal dark stripes black mixed with Ochraceous-Tawny; median pair of dorsal light stripes grayish white with Ochraceous-Tawny along margins; lateral pair of light dorsal stripes white; sides Ochraceous-Tawny or Light Sayal Brown; rump and thighs Smoke Gray mixed with Cinnamon-Buff; dorsal surface of tail Fuscous Black mixed with Cinnamon-Buff; ventral surface of tail Sayal Brown, Fuscous Black along margin, and Cinnamon-Buff or Ochraceous Buff along outermost edge; antipalmar and antiplantar surfaces of feet Light Pinkish Cinnamon or Pinkish Buff; underparts grayish white mixed slightly with Buff. *Skull* and *Baculum:* Small but proportionally the same as in other subspecies of *E. minimus.*

Comparisons.—From *E. m. pallidus,* the subspecies to the east, *E. m. consobrinus* differs in: Color darker; size smaller; skull narrower and shorter; baculum shorter.

From *E. m. confinis,* the subspecies from the Big Horn Mountains, *E. m. consobrinus* differs in: Over-all tone of upper parts less grayish; underside of tail lighter; skull narrower and shorter; baculum shorter.

For comparisons with *E. m. minimus* see the account of that subspecies.

Remarks.—Specimens of this subspecies from the area between the Uinta Mountains and the mountains of the Wyoming and Wind River ranges, are clearly intergrades between *E. m. consobrinus* and *E. m. minimus* and are here referred to *E. m. consobrinus.* These specimens are paler than typical *E. m. consobrinus* and considerably darker than *E. m. minimus.* These intergrades came from an area where the habitat is intermediate between that of *E. m. consobrinus* and *E. m. minimus* but more nearly like that of *E. m. consobrinus.*

Specimens examined.—Total number, 135.

Yellowstone Park: Fishing Bridge, 1 (MM).

Park Co.: SW slope Whirlwind Peak, 9,000 ft., 1.

Teton Co.: N end Blacktail Butte, 6,600 ft., 1 mi. E Moose, 1; Bar BC Ranch, 6,500 ft., 2½ mi. NE Moose, 2; 3¾ mi. E Moose, 6,300 ft., 3; 3¾ mi. E and ¾ mi. S Moran, 6,210 ft., 2; 5 mi. S Moran, 1 (FC); 2 mi. S Elk Ranch, 2 (FC); 7 mi. S Moran, 1 (FC); 19 mi. E and 2 mi. S Moran, 1; Flat Creek Pass, 1 (MM); Flat Creek-Crystal Creek Divide, 1 (MM); Flat Creek-Granite Creek Divide, 5 (MM); Dry Hollow, Jackson, 1 (MM); Jackson, 4 (MM); Jenny Lake, 2 (MM); Sheep Creek, Jackson, 1 (MM).

Lincoln Co.: 3 mi. N and 11 mi. E Alpine, 5,650 ft., 2; 13 mi. N and 2 mi. W Afton, 6,100 ft., 2; 10 mi. N and 2 mi. W Afton, 6,100 ft., 2; 6 mi. N and 2 mi. E Sage, 6,050 ft., 1; Kemmerer, 1; Cumberland, 14 mi. S and 1 mi. W Kemmerer, 6,550 ft., 6.

Sublette Co.: 5 mi. E and 9 mi. N Pinedale, 9,200 ft., 12; 10 mi. NE Pinedale, 8,000 ft., 2; W end Half Moon Lake, 7,900 ft., 5; 3 mi. E and 5 mi. N Pinedale, 7,500 ft., 3; 2¼ mi. NE Pinedale, 7,500 ft., 3; 4 mi. W Pinedale, 7,200 ft., 2; 19 mi. W and 2 mi. S Big Piney, 7,700 ft., 1; 31 mi. N Pinedale, 8,025 ft., 2.

Fremont Co.: Togwotee Pass, 3 (1 FC); Moccasin Lake, 10,100 ft., 19 mi. W and 4 mi. N Lander, 1; 16 mi. S and 5½ mi. W Lander, 8,650 ft., 1; 23½ mi. S and 5 mi. W Lander, 8,600 ft., 1; 3 mi. E and ½ mi. N South Pass City, 7,900 ft., 7; Mosquito Park R. S., 9,500 ft., 17½ mi. W and 2½ mi. N Lander, 1; 4 mi. S and 8½ mi. W Lander, 9,200 ft., 1.

Uinta Co.: ½ mi. S Cumberland [Lincoln County], 1; 2 mi. W Fort Bridger, 6,070 ft., 1; 8½ mi. W Fort Bridger, 6,700 ft., 17; ½ mi. S Mountain View, 6,900 ft., 2; 6 mi. S and 2½ mi. E Robertson, 8,200 ft., 3; 8 mi. S and 2½ mi. E Robertson, 8,300 ft., 1; 9 mi. S Robertson, 8,000 ft., 5; 9½ mi. S and 1 mi. W Robertson, 8,600 ft., 2; 10 mi. S and 1 mi. W Robertson, 8,700 ft., 4; 13 mi. S and 2 mi. E Robertson, 9,200 ft., 7; 2 mi. E and 12 mi. S Robertson, Ashley Nat. For., 9,000 ft., 1; 11½ mi. S and 2 mi. E Robertson, 9,200 ft., 1; 4½ mi. S and 4 mi. E Robertson, 8,025 ft., 1.

Additional records (Howell 1929:48): *Yellowstone Park:* Bunsen Peak; Swan Lake Valley; Canyon; Lake Station; Firehole River; Summit Lake; Snow Pass. *Park Co.:* Beartooth Lake; Whirlwind Peak, near Pahaska Tepee; Valley; Needle Mountain. *Teton Co.:* Elk, Jackson Hole; Teton Pass. *Lincoln Co.:* Thayne; head of La Barge Creek; Smith Fork, 7,000 to 8,000 ft. *Sublette Co.:* 12 mi. N Kendall; Merna; Fremont Lake; Surveyor Park, 12 mi. NE Pinedale; Bronx; Little Sandy Creek; Stanley; Big Sandy. *Fremont Co.:* Lake Fork, Wind River Mountains; Fremont Peak; South Pass City. *Uinta Co.:* Bear River Divide, 14 mi. N Evanstone; Evanstone; Ft. Bridger; Spring Valley; Henry's Fork, 5 mi. W Lone Tree; Lone Tree; Sage Creek (exact locality unknown).

Eutamias minimus pallidus (J. A. Allen)

Tamias quadrivittatus b. var. *pallidus* J. A. Allen, Proc. Boston Soc. Nat. Hist. 16:289, 1874.
Eutamias minimus pallidus, Howell, Jour. Mamm. 3:183, August 4, 1922.

Lectotype.—Skull and skin, No. 11656/38311 (NM); from Camp Thorne, near Glendive, Dawson County, Montana; obtained on July 18, 1873, by J. A. Allen; original No. 200.

Diagnosis.—Size large; over-all tone of upper parts pale grayish brown; baculum large.

Description.—Color pattern: Crown Pale Smoke Gray mixed with Clay Color; facial stripes Fuscous Black mixed with Clay Color; anterior margin of

ear and hairs inside posterior part of pinna Pale Pinkish Buff; posterior margin of ear and postauricular patch grayish white; median dorsal dark stripe black with Clay Color along margins; other dorsal dark stripes Fuscous mixed with Clay Color; median pair of dorsal light stripes Pale Smoke Gray; lateral pair of dorsal light stripes creamy white; sides Cinnamon-Buff; rump and thighs Smoke Gray mixed with Pale Buff; dorsal surface of tail Fuscous Black slightly mixed with Warm Buff; ventral surface of tail Pinkish Cinnamon or Pinkish Buff, with Fuscous Black along margin and Warm Buff along outermost edge; antipalmar and antiplantar surfaces of feet Pinkish Buff, Warm Buff or Pale Yellow-Orange; underparts white with dark underfur. *Skull* and *Baculum:* Large but of same proportions as in other subspecies of *E. minimus.*

Comparisons.—From *E. m. silvaticus,* the subspecies from the Black Hills, *E. m. pallidus* differs in: Paler; underside of tail paler; sides paler.

From *E. m. confinis,* the subspecies from the Big Horn Mountains, *E. m. pallidus* differs in: Over-all tone of upper parts paler; sides paler; underside of tail paler.

From *E. m. operarius,* the subspecies from the mountains in south-central Wyoming, *E. m. pallidus* differs in: Over-all tone of upper parts paler; sides paler; underside of tail paler.

For comparisons with *E. m. minimus* and *E. m. consobrinus,* see the accounts of those subspecies.

Remarks.—Specimens from near Buffalo, Johnson Co., are intergrades between *E. m. pallidus* and *E. m. confinis* and are referable to *E. m. confinis.* Specimens from near Sundance (not in Bear Lodge Mountains), Crook Co., are intergrades between *E. m. pallidus* and *E. m. silvaticus* (Howell 1929:55). Specimens from the Laramie Range in Converse Co. are intergrades between *E. m. pallidus* and *E. m. operarius,* and referable to *E. m. operarius.* Specimens from near Greybull, Big Horn Co., are intergrades between *E. m. pallidus* and *E. m. minimus* and are referable to *E. m. pallidus.* These specimens show no intergradation with *E. m. confinis* which occurs but a short distance to the east in the Big Horn Mountains. Intergradation between *E. m. pallidus* and *E. m. minimus* probably exists in northeastern Natrona Co. and southwestern Johnson Co.

Comparisons of specimens of *E. m. pallidus* and *E. m. cacodemus,* indicates that, in my opinion, *E. m. cacodemus* is entitled to subspecific recognition, for, the relationship between *E. m. pallidus* to *E. m. cacodemus* is the same as that between *E. m. pallidus* and *E. m. confinis.*

Specimens examined.—Total number, 58.

Park Co.: 2 mi. S and 2 mi. E Meteetse, 5,750 ft., 3.

Big Horn Co.: 6 mi. NW Greybull, 3,800 ft., 6; Greybull, 4 (BS); 7 mi. S Basin, 3,900 ft., 5.

Sheridan Co.: 5 mi. NE Clearmont, 3,900 ft., 1.

Campbell Co.: 5 mi. N and 8 mi. W Spotted Horse, 9; 6 mi. W and 4 mi. S Rockypoint, 4,200 ft., 1; 4 mi. S and 3 mi. W Rockypoint, 5; Middle Butte, 6,010 ft., 38 mi. S and 19 mi. W Gillette, 3; South Butte, 6,000 ft., 17½ mi. W and 40½ mi. S Gillette, 2; Ivy Creek, 8 mi. W and 5 mi. N Spotted Horse, 6.

Crook Co.: Moorcroft, Belle Fourche Valley, 8 (BS).

Washakie Co.: 15 mi. W Tensleep, in badlands, 1 (BS); 8 mi. S and 8 mi. W Worland, 1; 10 mi. S Tensleep, near No Wood Creek, 2 (BS).

Goshen Co.: Rawhide Buttes, 12 mi. S and 1 mi. W Lusk, 1.

Laramie Co.: unspecified, 1.

Additional records (Howell 1929:44): *Big Horn Co.:* Otto; Hyattville. *Sheridan Co.:* Powder River at mouth of Clear Creek; Sheridan; Arvada. *Weston Co.:* Thornton; Upton; Pine Ridge; Newcastle. *Hot Springs Co.:* head of Bridger Creek; Willow Creek, 10 mi. SW Thermopolis. *Washakie Co.:* 10 mi. S Manderson; Otter Creek, Bighorn Basin. *Johnson Co.:* Powder River Basin, near Pumpkin Buttes. *Natrona Co.:* Merino. *Converse Co.:* Douglas. *Platte Co.:* Guernsey; 15 mi. SW Wheatland. *Goshen Co.:* Rawhide Butte. *Localities for which counties are unknown:* Owl Creek Mountains; North Platte River.

Eutamias minimus confinis Howell

Eutamias minimus confinis Howell, Jour. Mamm. 6:52, February 15, 1925.

Type.—Female, adult, skull and skin No. 168957 (NM); from head of Trapper Creek, west slope of Bighorn Mountains, Big Horn County, Wyoming; obtained on July 7, 1910, by Merrit Cary; original No. 1956.

Diagnosis.—Size large; over-all tone of upper parts grayish brown; baculum large, as in *E. m. pallidus.*

Description.—Color pattern: Crown Clay Color mixed with Pale Smoke Gray; upper facial stripe Fuscous Black; other facial stripes Fuscous Black slightly mixed with Tawny; anterior margin of ear Yellow Ocher or Ochraceous-Orange; hairs inside posterior part of pinna Yellow Ocher or Ochraceous-Orange; posterior margin of ear Smoke Gray; postauricular patch buffy white or Smoke Gray; dorsal dark stripes black or Fuscous Black more or less mixed with Tawny or Tawny-Olive; dorsal light stripes creamy white, sometimes washed with Pale Smoke Gray; sides Raw Sienna or Cinnamon-Buff; rump and thighs Pale Smoke Gray mixed with Tawny-Olive; dorsal surface of tail black mixed with Clay Color; ventral surface of tail Clay Color, black along margin and Light Buff or Light Ochraceous Buff along outermost edge; antipalmar and antiplantar surfaces of feet Pinkish Buff; underparts creamy white sometimes with grayish underfur. *Skull* and *Baculum:* Large but proportionally the same as in other subspecies of *E. minimus.*

Comparisons.—From *E. m. silvaticus,* the subspecies from the Black Hills, *E. m. confinis* differs in: General tone of upper parts darker, more reddish and less grayish; ventral surface of tail more tawny; skull and baculum of same size and proportions.

From *E. m. operarius,* the subspecies from the Laramie Range and other mountains of south-central Wyoming, *E. m. confinis* differs in: Rump and thighs darker; sides darker; general tone of upper parts more grayish.

For comparisons with *E. m. minimus, E. m. consobrinus,* and *E. m. pallidus,* see the accounts of those subspecies.

Remarks.—This subspecies is endemic to the Bighorn Mountains. Intergradation between *E. m. confinis* and *E. m. minimus* and between *E. m. pallidus* and *E. m. confinis* have already been discussed in the accounts of those subspecies.

Specimens examined.—Total number, 85.

Big Horn Co.: 12 mi. E and 2 mi. S Shell, 7,900 ft., 2; 13 mi. E and 2 mi. N Shell, 8,500 ft., 2; 13 mi. E Shell, 8,300 ft., 1; 17 mi. E and 3 mi. S Shell, 9,000 ft., 8; 17½ mi. E and 4½ mi. S Shell, 8,500 ft., 11; 19 mi. E and 4½ mi. S Shell, 9,600 ft., 1; 9 mi. E and 9 mi. N Tensleep, 8,200 ft., 4.

Sheridan Co.: Medicine Wheel Ranch, 9,000 ft., 28 mi. E Lovell, 11; 38 mi. E Lovell, Big Horn Nat. For., 9,600 ft., 10; 5½ mi. W and 1½ mi. S Junction U. S. Highway 14 and Wyoming [State Highway] 14, 8,480 ft., 2.

Washakie Co.: 9 mi. E and 4 mi. N Tensleep, 7,000 ft., 26; 3 mi. SE Tensleep, 4,300 ft., 1.

Johnson Co.: 5½ mi. W and 1 mi. S Buffalo, 6,500 ft., 4; 7½ mi. W and 1 mi. S Buffalo, 6,500 ft., 2.

Additional records (Howell 1929:46): *Sheridan Co.:* 20 mi. from Sheridan. *Washakie Co.:* Head of Canyon Creek. *Johnson Co.:* Head of North Fork of Powder River.

Eutamias minimus silvaticus White

Eutamias minimus silvaticus White, Univ. Kansas Publ. Mus. Nat. Hist. 5(19):259-262, April 10, 1952.

Type.—Female, adult, skull and skin, No. 20050 (KU); from 3 mi. NW Sundance, 5,900 ft., Crook County, Wyoming; obtained on July 4, 1947, by H. W. Setzer; original No. 1692.

Diagnosis.—Size large; over-all tone of upper parts brownish gray; sides Ochraceous-Buff; baculum as in *E. m. pallidus.*

Description.—Color pattern: Crown Sayal Brown washed with Cinnamon-Buff; facial stripes Fuscous Black mixed with Clay Color; anterior margin of ear Ochraceous-Orange; hairs inside posterior part of pinna Ochraceous-Buff; posterior margin of ear and postauricular patch grayish white; dorsal dark stripes Fuscous Black more or less mixed with Ochraceous-Buff; medial dorsal light stripes Pale Smoke Gray with Ochraceous-Buff along margins; lateral dorsal light stripes grayish white or white with Ochraceous-Buff along margins; sides Ochraceous-Buff; rump and thighs Smoke Gray washed with Ochraceous-Buff; dorsal surface of tail black interspersed with Ochraceous-Buff; ventral surface of tail Ochraceous-Orange, with black along margin and Light Ochraceous-Buff along outermost edge; antipalmar and antiplantar surfaces of feet Light Buff; underparts creamy white sometimes washed with Ochraceous-Buff. *Skull* and *Baculum:* Large but of same proportions as in other subspecies of *E. minimus.*

Comparisons.—From *E. m. operarius,* the subspecies from south-central Wyoming, *E. m. silvaticus* differs in: Underside of tail lighter; general tone of upper parts grayer; sides lighter; skull and baculum of same size and proportions.

For comparisons with *E. m. pallidus* and *E. m. confinis,* see the accounts of those subspecies.

Remarks.—Intergradation between *E. m. silvaticus* and *E. m. pallidus* has already been discussed under the account of *E. m. pallidus.*

Specimens examined.—Total number, 42.

Crook Co.: 15 mi. N Sundance, Black Hills Nat. Forest, 5,500 ft., 6; 15 mi. ENE Sundance, 3,825 ft., 1; 3 mi. NW Sundance, 5,900 ft., 14; 1 mi. N Sundance, Black Hills Nat. Forest, 1.

Weston Co.: 1½ mi. E Buckhorn, 6,150 ft., 19; SE Newcastle, 1 (MM).

Additional records (Howell 1929:57): *Crook Co.:* Devils Tower; Sundance.

Eutamias minimus operarius Merriam

Eutamias amoenus operarius Merriam, Proc. Biol. Soc. Washington, 18:164, June 29, 1905.
Eutamias minimus operarius, Howell, Jour. Mamm. 3:183, August 4, 1922.

Type.—Female, adult, skull and skin, No. 129808 (BS); from Gold Hill, 7,400 ft., Boulder County, Colorado; obtained on October 8, 1903, by Vernon Bailey; original No. 8160.

Diagnosis.—Size large; general tone of upper parts dark reddish brown; sides Tawny or Ochraceous-Tawny; baculum large, as in *E. m. pallidus.*

Description.—*Color pattern:* Crown Cinnamon-Buff mixed with Pale Smoke Gray; facial stripes Fuscous Black mixed with Sayal Brown; anterior margin of ear and hairs inside posterior part of pinna Cinnamon-Buff; posterior margin of ear and postauricular patch Pale Smoke Gray; dorsal dark stripes black with Ochraceous-Tawny along margins; median dorsal light stripes Pale Smoke Gray with Ochraceous-Tawny along margins; lateral dorsal light stripes white; sides Tawny or Ochraceous-Tawny; rump and thighs Light Grayish Olive; dorsal surface of tail Fuscous Black slightly mixed with Clay Color; ventral surface of tail Sayal Brown or Ochraceous-Tawny with Fuscous Black along margin and Clay Color along outermost edge; antipalmar and antiplantar surfaces of feet Ochraceous-Buff; underparts grayish white, often washed with Buff. *Skull* and *Baculum:* Large but of same proportions as in other subspecies of *E. minimus.*

Comparisons.—For comparisons with *E. m. minimus, E. m. pallidus, E. m. confinis,* and *E. m. silvaticus,* see the accounts of those subspecies.

Remarks.—Specimens from the mountains near Savery in Carbon County and from near Medicine Bow Peak in Carbon and Albany counties are clearly referable to this race on the basis of color pattern. However, in the skull and baculum these specimens resemble *E. m. minimus.*

Specimens from the Laramie Range, 27 mi. N Laramie, show a color pattern which tends toward that of *E. m. pallidus.*

Specimens examined.—Total number, 118.

Natrona Co.: 2 mi. W and 7 mi. S Casper, 6,370 ft., 2; 10 mi. S Casper, 7,750 ft., 3; 6 mi. S and 2 mi. W Casper, 5,900 ft., 1.

Converse Co.: 21½ mi. S and 24½ mi. W Douglas, 7,600 ft., 10.

TABLE 1

Average and Extreme Measurements in Millimeters of Adult Chipmunks that Occur in Wyoming

	Greatest length of skull	Zygomatic breadth	Cranial breadth	Length of nasals	Total length	Length of tail	Length of lower tooth-row	Condylo-alveolar length of mandible
	E. m. minimus, S of Bitter Creek, Sweetwater Co.							
Mean..... (5)	29.9	16.7	14.8	9.0	188	84.6	4.65	15.51
Min..... ♂	29.0	16.5	14.6	8.6	177	81.0	4.52	15.11
Max.....	30.9	17.2	15.0	9.8	197	89.0	4.80	16.21
Mean..... (6)	30.1	17.2	15.1	8.6	193	85.3	4.69	16.08
Min..... ♀	29.0	16.8	14.9	7.9	184	80.0	4.53	15.71
Max.....	30.8	17.7	15.5	9.4	200	93.0	4.91	16.58
	E. m. consobrinus, near Jackson, Teton Co.							
Mean..... (4)	30.1	16.6	14.4	8.6	190	83.0	4.48	15.65
Min..... ♂	29.6	16.4	14.3	8.5	190	80.0	4.43	15.28
Max.....	30.7	16.9	14.6	8.8	192	86.0	4.59	15.99
Mean..... (6)	30.8	17.1	14.5	9.1	200	88.4	4.60	16.05
Min..... ♀	30.2	16.9	14.1	8.7	195	85.0	4.43	15.60
Max.....	31.3	17.5	15.1	9.5	205	92.0	4.84	16.70
	E. m. pallidus, Moorcroft and Rockypoint, Weston Co.							
Mean..... (9)	31.8	18.0	15.3	9.3	193	85.8	4.84	16.74
Min..... ♂	31.4	17.7	14.9	8.5	185	80.0	4.34	16.23
Max.....	32.5	18.7	15.9	9.7	204	91.0	5.02	17.21
Mean..... (7)	32.2	18.2	15.5	9.6	205	91.0	4.97	17.02
Min..... ♀	31.4	17.8	15.1	9.1	203	86.0	4.70	16.30
Max.....	32.9	18.9	16.0	10.3	214	99.0	5.18	17.39
	E. m. confinis, Bighorn Mts., near Tensleep, Washakie Co.							
Mean..... (9)	31.6	17.8	15.4	9.3	205	89.6	4.78	16.71
Min..... ♂	30.4	17.2	14.9	8.9	194	79.0	4.51	16.18
Max.....	33.3	19.0	16.2	9.9	228	113.0	5.09	17.70
Mean..... (8)	32.4	18.7	15.6	9.6	208	88.8	4.83	17.09
Min..... ♀	31.7	17.9	15.3	9.2	189	76.0	4.69	16.49
Max.....	33.1	19.3	16.1	9.7	226	103.0	4.93	17.73

Table 1.—*Continued*

	Greatest length of skull	Zygomatic breadth	Cranial breadth	Length of nasals	Total length	Length of tail	Length of lower tooth-row	Condylo-alveolar length of mandible
	E. m. silvaticus, 16 mi. N Custer, Pennington Co., S. D.							
Mean..... (19)	32.3	18.2	15.5	9.6	200	86.2	4.85	16.78
Min..... ♂	31.5	17.4	15.0	9.1	189	76.0	4.63	16.19
Max.....	33.4	19.4	16.1	10.2	210	94.0	5.13	17.74
Mean..... (15)	32.6	18.1	15.7	9.5	208	90.2	4.96	16.90
Min..... ♀	31.5	17.7	15.0	9.1	189	70.0	4.61	16.26
Max.....	33.7	19.2	16.2	10.5	220	105.0	5.29	18.28
	E. m. operarius, near Pole Mt., Albany Co.							
Mean..... (9)	31.5	17.6	15.2	9.7	193	85.6	4.78	16.52
Min..... ♂	30.3	17.0	14.9	8.9	183	77.0	4.58	15.63
Max.....	32.4	18.2	15.5	10.6	203	91.0	5.12	17.37
Mean..... (8)	32.2	18.0	15.4	9.7	203	85.7	4.86	16.50
Min..... ♀	31.1	17.6	15.0	9.2	194	79.0	4.64	15.44
Max.....	33.4	18.5	15.8	10.2	212	92.0	5.11	17.21
	E. a. luteiventris, near Moran, Teton Co.							
Mean..... (20)	33.6	18.2	15.5	10.6	212	94.8	5.14	17.27
Min..... ♂	32.2	17.4	14.9	9.8	198	87.0	4.86	16.42
Max.....	35.2	18.7	16.2	12.1	221	108.0	5.37	18.39
Mean..... (10)	33.8	18.5	15.5	11.1	217	91.7	5.13	17.47
Min..... ♀	33.4	18.1	15.1	10.5	203	81.0	5.06	16.89
Max.....	34.7	19.0	16.0	11.5	225	100.0	5.32	18.33
	E. d. utahensis, W side Green River, 1 mi. N Utah border.							
Mean..... (4)	34.7	18.9	16.4	10.8	197	84.5	5.08	17.91
Min..... ♂	34.7	18.7	16.4	10.5	191	81.0	5.00	17.77
Max.....	34.8	19.2	16.4	11.1	203	88.0	5.15	18.06
Mean..... (2)	36.0	19.5	16.3	11.3	211	88.0	5.25	18.87
Min..... ♀	35.5	19.4	16.2	11.3	210	86.0	5.22	18.73
Max.....	36.6	19.7	16.4	11.4	212	90.0	5.28	19.02

TABLE 1.—*Concluded*

	Greatest length of skull	Zygomatic breadth	Cranial breadth	Length of nasals	Total length	Length of tail	Length of lower tooth-row	Condylo-alveolar length of mandible
	E. u. umbrinus, Mts. S Robertson, Uinta Co.							
Mean..... (11)	34.7	18.9	15.7	10.9	218	96.2	5.13	18.04
Min..... ♂	34.3	18.3	15.6	10.3	215	81.0	4.79	17.57
Max.....	35.2	19.4	16.0	11.7	228	112.0	5.42	18.59
Mean..... (4)	35.1	19.2	15.9	11.0	224	96.4	5.17	18.46
Min..... ♀	34.9	19.2	15.7	10.3	204	90.0	5.11	18.31
Max.....	35.4	20.0	16.2	11.8	234	100.0	5.22	18.98
	E. u. fremonti, Togwotee Pass, Fremont Co.							
Mean..... (8)	35.6	19.3	15.9	11.4	223	99.0	5.34	19.17
Min..... ♂	35.2	18.9	15.8	11.1	216	95.0	5.22	18.72
Max.....	36.5	19.7	16.1	11.8	243	111.0	5.57	19.78
Mean..... (6)	35.3	19.6	15.9	11.3	229	101.0	5.40	19.02
Min..... ♀	34.5	19.3	15.7	10.9	223	92.0	5.35	18.37
Max.....	36.0	20.0	16.5	12.0	239	110.0	5.44	19.51
	E. u. montanus, near Longs Peak, Boulder Co., Colorado.							
Mean..... (5)	35.2	18.8	15.5	10.8	226	96.0	5.20	18.29
Min..... ♂	34.7	18.4	15.2	10.1	215	93.0	5.03	17.80
Max.....	36.8	19.4	16.2	11.5	232	115.0	5.53	19.36
Mean..... (6)	35.7	19.1	15.6	10.9	226	98.0	5.28	18.67
Min..... ♀	35.1	18.8	15.1	10.3	215	89.0	5.06	18.09
Max.....	36.5	19.5	16.0	11.5	231	105.0	5.58	19.35

Carbon Co.: Lake Marie, 10,440 ft., 1; 2 mi. S and ½ mi. W Medicine Bow Peak, 10,400 ft., 1; 2 mi. S and 2 mi. W Medicine Bow Peak, 10,700 ft., 1; 10 mi. N and 14 mi. E Encampment, 8,000 ft., 2; 8 mi. N and 14 mi. E Encampment, 8,400 ft., 2; 8 mi. N and 16 mi. E Encampment, 8,400 ft., 3; 21½ mi. E and 8 mi. N Encampment, 9,400 ft., 2; 10 mi. E and 6 mi. S Saratoga, 8,800 ft., 1; 8 mi. N and 19½ mi. E Savery, 8,800 ft., 16; 17 mi. E and 7 mi. N Savery, 8,300 ft., 1; 7 mi. N and 19 mi. E Savery, 10,128 ft., 1; 14 mi. E and 6 mi. N Savery, 8,400 ft., 1; 5 mi. N and 5 mi. E Savery, 6,900 ft., 2.

Albany Co.: 27 mi. N and 7½ mi. E Laramie, 6,960 ft., 12; 13 mi. E and 9 mi. N Laramie, 7,700 ft., 2; 8¾ mi. E and 6½ mi. S Laramie, 8,200 ft., 1; 5½ mi. ESE Laramie, 8,500 ft., 1; 8 mi. E and 4 mi. S Laramie, 8,600 ft., 1; 2 mi. SE Pole Mountain, 8,200 ft., 19; 3 mi. S Pole Mountain, 8,100 ft., 2; 1 mi. SSE Pole Mountain, 8,350 ft., 3; 3 mi. ESE Browns Peak, 10,000 ft., 15; 2½ mi. ESE Browns Peak, 10,300 ft., 1.

Laramie Co.: 5 mi. W Horse Creek P. O., 7,200 ft., 2; 3½ mi. W Horse Creek P. O., 7,000 ft., 3; 2 mi. W Horse Creek P. O., 6,600 ft., 1.

Additional records (Howell 1929:51): *Natrona Co.:* Casper Mountains, 7 mi. S Casper. *Carbon Co.:* Bridger Peak; Riverside. *Albany Co.:* Springhill, 12 mi. N Laramie Peak; Eagle Peak; Bear Creek, 3 mi. SW Eagle Peak; Laramie Mountains, 10 mi. E Laramie; Woods [= Woods Landing]; Sherman. *Laramie Co.:* Bluffs near Pole Creek; 6 mi. W Islay.

Eutamias amoenus (J. A. Allen)

Diagnosis.—Size medium; over-all tone of upper parts often grayish olive; baculum small or medium, slender; tip of baculum 30 to 38 per cent of length of shaft; skull medium, narrow across zygomata.

Comparisons.—From *E. dorsalis utahensis,* the only subspecies of this species in Wyoming, *E. amoenus luteiventris* differs in: Dorsal light and dark stripes distinct; over-all tone of upper parts less grayish (more tawny); tip of baculum less than 38 per cent of length of shaft in adult specimens.

From *E. umbrinus fremonti,* the only subspecies of this species which occurs in the same area with *E. amoenus* in Wyoming, *E. a. luteiventris* differs in: Smaller size; tawny underparts; base of baculum not noticeably widened.

For comparisons with *E. minimus* see the account of that species.

Eutamias amoenus luteiventris (J. A. Allen)

Tamias quadrivittatus luteiventris J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:101, June, 1890.
Eutamias amoenus luteiventris, Howell, Jour. Mamm., 3:183, August 4, 1922.

Type.—Male, adult, skull and skin, No. 11991/37996 (NM); from "Chief Mountain Lake" [Waterton Lake], 3½ mi. N United States-Canadian Boundary, Alberta; obtained on August 24, 1874, by Elliot Coues; original No. 4596.

Diagnosis.—General tone of upper parts ochraceous; underparts strongly buffy; tip of baculum in adult specimens, more than 30 per cent and less than 38 per cent of length of shaft.

Description.—Color pattern: Crown Cinnamon mixed with Smoke Gray; upper two facial stripes black; submalar stripe Fuscous or Fuscous Black mixed with Ochraceous-Tawny; anterior margin of ear Ochraceous-Tawny; posterior margin of ear and postauricular patch Light Buff or buffy white; hairs inside posterior part of pinna Ochraceous-Tawny; median dorsal dark stripe black; lateral pair of dorsal dark stripes black and mixed with Tawny, frequently brownish; median pair of dorsal light stripes white tinged with Pale Smoke

Gray; lateral pair of dorsal light stripes creamy white; sides Tawny or Ochraceous-Tawny; rump and thighs Dark Smoke Gray strongly mixed with Cinnamon-Buff; dorsal surface of tail Fuscous Black mixed with Clay Color; ventral surface of tail Light Ochraceous Tawny, with Fuscous Black around margin and Clay Color around outermost edge; antipalmar and antiplantar surfaces of feet Cinnamon or Cinnamon-Buff; underparts Cinnamon-Buff or Light Ochraceous-Buff. *Skull:* Size medium; moderately narrowed across zygomata. *Baculum:* Slender; not noticeably broadened at base; tip more than 30 per cent of length of shaft.

Remarks.—Although there are no records of this subspecies from the Wind River Mountains, it probably occurs there.

The niche that this subspecies occupies is similar to that of *E. m. consobrinus* as shown by the fact that these two subspecies have been taken together at the same places.

Specimens of *E. a. luteiventris* and *E. umbrinus fremonti* have been taken together at the same places.

In general, *E. m. consobrinus* occurs in open country and at the edges of forests, whereas *E. u. fremonti* occurs in the forest. *E. a. luteiventris* occurs in the intermediate habitat, that is to say, not far into the forest, and not so far out into the open as *E. m. consobrinus.*

Specimens examined.—Total number, 83.

Yellowstone Park: Unspecified, 2.

Park Co.: 31½ mi. N and 36 mi. W Cody, 6,900 ft., 6; 29 mi. N and 31 mi. W Cody, 7,200 ft., 1; 28 mi. N and 30 mi. W Cody, 7,200 ft., 1; 16¼ mi. N and 17 mi. W Cody, 5,625 ft., 3; 25 mi. S and 28 mi. W Cody, 6,350 ft., 2.

Teton Co.: Two Ocean Lake, 2 (1 FC); Whetstone Creek, 8 (MM); Emma Matilda Lake, 1 (FC); Pacific Creek Road, 2½ mi. E Moran, 1 (FC); Two Ocean Lake Road, 2 (FC); 2 mi. E Moran, 1 (FC); 2½ mi. E and ¼ mi. N Moran, 6,230 ft., 8; Pacific Creek, 1 (MM); junction of Two Ocean Lake Road and U. S. Highway 187, 2 (FC); Signal Mountain Road, 1 (FC); Leigh Lake, 9 (MM); Indian Paint Brush Canyon, Teton Park, 1 (MM); Teton National Park, 3; 3 mi. E and ¼ mi. S Moran, 6,200 ft., 1; 3¾ mi. E and 1 mi. S Moran, 6,200 ft., 8; 2½ mi. N and 3½ mi. E Moran, 7,225 ft., 1; Timbered Island, 6,750 ft., 4 mi. N Moose, 5; Bar BC Ranch, 6,500 ft., 2½ mi. NE Moose, 9; Grand Teton, 9,000 ft., Teton Park, 1 (MM); Upper Arizona Creek, Jackson, 1 (MM).

Lincoln Co.: 3 mi. N and 11 mi. E Alpine, 5,650 ft., 2.

Additional records (Howell 1929:69): *Yellowstone Park:* Mammoth Hot Springs; Roaring Mountain; Bunsen Peak; Yancey; Apollinaris Spring; Canyon; Yellowstone Lake; Upper Geyser Basin; Old Faithful. *Park Co.:* Near head of Clarks Fork; Pahaska, N Fork Shoshone River at Grinnell Creek; Valley. *Teton Co.:* Moran; Teton Mountains; Teton Pass. *Lincoln Co.:* Afton, Salt River Mountains; head of La Barge Creek, 9,100 ft.; Salt River Mountains, 10 mi. SE Afton. *Sublette Co.:* Merna; Stanley.

Eutamias dorsalis (Baird)

Diagnosis.—Size medium to large; general tone of upper parts Smoke Gray; dorsal stripes indistinct or obsolete; often brightly colored at base of tail; keel of baculum proportionally high, approximately ⅓ of length of tip; skull longer than 34.5 mm.

Comparisons.—From *E. umbrinus, E. dorsalis* differs in: Dorsal stripes faint; skull smaller; base of baculum not noticeably expanded; general tone of upper parts grayer.

For comparisons with *E. minimus* and *E. amoenus* see the accounts of those species.

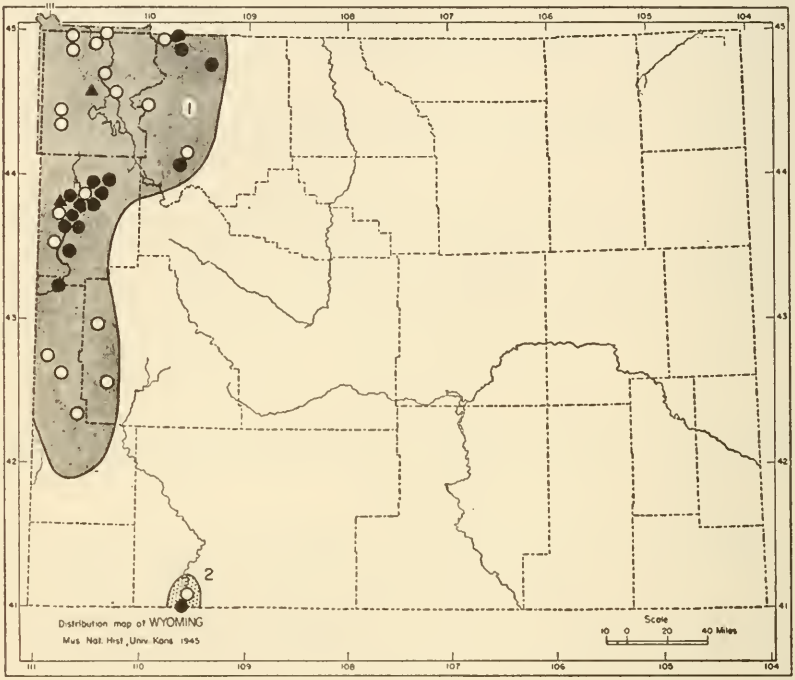

Fig. 2. Known occurrences and probable geographic distribution of *Eutamias amoenus* and *Eutamias dorsalis* in Wyoming. See figure 1 for explanation of symbols.

1. *E. amoenus luteiventris* 2. *E. dorsalis utahensis*

Eutamias dorsalis utahensis Merriam

Eutamias dorsalis utahensis Merriam, Proc. Biol. Soc. Washington, 11:210, July 1, 1897.

Type.—Male, adult, skull and skin, No. 186457 (NM); from Ogden, Weber County, Utah; obtained on October 9, 1888, by Vernon Bailey; original No. 289.

Diagnosis.—Size medium; dorsal stripes faint; baculum not noticeably widened at base.

Description.—*Color pattern:* Crown Pale Smoke Gray mixed with Cinnamon; upper facial stripe Fuscous; other facial stripes Sayal Brown mixed with Fuscous or Fuscous Black; anterior margin of ear Ochraceous-Tawny; posterior margin of ear and postauricular patch grayish white; median dorsal dark stripe Fuscous

or black; other dorsal dark stripes black and mixed with gray, sometimes barely discernible; dorsal pair light stripes Smoke Gray; lateral pair of light stripes creamy white; rump and thighs Pale Smoke Gray mixed with Cinnamon; dorsal surface of tail Fuscous Black mixed with Tilleul Buff; underside of tail Cinnamon-Buff or Pinkish Buff, Fuscous Black around margin and Tilleul Buff around outermost edge; antipalmar and antiplantar surfaces of feet Cinnamon Buff; underparts creamy white; sides Pinkish Cinnamon or Light Pinkish Cinnamon. *Skull:* Size medium; braincase well inflated; zygomata strong, moderately appressed to cranium. *Baculum:* Small; keel approximately ⅓ of length of tip.

Remarks.—Only a few specimens of this subspecies have ever been taken in Wyoming. Little is known about the habits of this chipmunk, which normally is shy and wary.

Specimens examined.—Total number, 6.

Sweetwater Co.: W side Green River, 1 mi. N Utah border, 6.

Additional records (Howell 1929:134): *Sweetwater Co.:* Green River, 4 mi. NE Linwood, Utah.

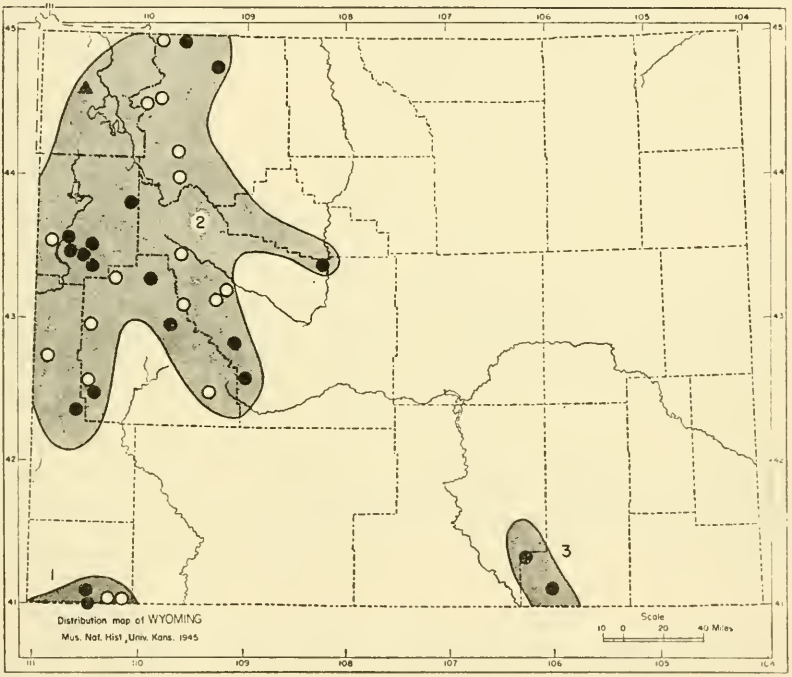

FIG. 3. Known occurrences and probable geographic distribution of the subspecies of *Eutamias umbrinus* in Wyoming. See figure 1 for explanation of symbols.

1. *E. u. umbrinus* 2. *E. u. fremonti* 3. *E. u. montanus*

Eutamias umbrinus (J. A. Allen)

Diagnosis.—Size large; general tone of upper parts dark; base of baculum widened; outermost dorsal dark stripe barely discernible or lacking; skull rarely shorter than 34.0 mm.

Comparisons.—For comparisons with the other species of *Eutamias* in Wyoming, see the accounts of *E. minimus, E. amoenus,* and *E. dorsalis.*

Remarks.—*E. umbrinus* is the largest of the species of *Eutamias* occurring in Wyoming. This species usually occurs in the Canadian and Hudsonian life-zones in the mountains of northwestern, southwestern, and south-central Wyoming.

Eutamias umbrinus umbrinus (J. A. Allen)

Tamias umbrinus J. A. Allen, Bull. Amer. Mus. Nat. Hist. 3:96, June, 1890.
Eutamias umbrinus, Miller and Rehn, Proc. Boston Soc. Nat. Hist., 30:45, December 27, 1901.

Type.—Male, adult, skull and skin, No. 186463 (NM); from Blacks Fork, about 9,500 ft., Uinta Mountains, Summit County, Utah; obtained on September 19, 1888, by Vernon Bailey; original No. 228.

Diagnosis.—Size medium; over-all tone of upper parts dark and shadowy; skull smallest of this species in Wyoming.

Description.—*Color pattern:* Crown Pale Smoke Gray; facial stripes Fuscous Black or Snuff Brown; ears Fuscous Black; posterior margin of ear and postauricular patch grayish white; median dorsal dark stripe black with Sayal Brown along margins; lateral pair of dorsal dark stripes Fuscous Black mixed with Sayal Brown, or entirely Sayal Brown; outermost pair of dorsal dark stripes Sayal Brown mixed with Fuscous Black or lacking; sides Sayal Brown mixed with Cinnamon; rump and thighs Sayal Brown mixed with Smoke Gray; antipalmar and antiplantar surfaces of feet Cinnamon-Buff; underside of tail Ochraceous-Tawny or Sayal Brown, with Fuscous Black around margin and Pinkish Buff around outermost edge; underparts creamy white with dark gray underfur. *Skull:* Smooth and rounded; braincase inflated; zygomata strong. *Baculum:* Broadened at base; shaft tapers rapidly to tip.

Comparisons.—From *E. u. fremonti,* the subspecies from the north in the mountains of northwestern Wyoming, *E. u. umbrinus* differs in: Over-all tone of upper parts darker; sides lighter; skull smaller. From *E. u. montanus,* the subspecies from the Medicine Bow Range of south-central Wyoming, *E. u. umbrinus* differs in: Over-all tone of upper parts darker; sides darker; skull smaller.

Remarks.—This subspecies occurs only in the foothills of the Uinta Mountains in the southern part of Uinta County. These "foothills" are well-timbered and at an altitude of 7,000 feet and higher.

Specimens examined.—Total number, 23.

Uinta Co.: 9 mi. S Robertson, 8,000 ft., 15; 10 mi. S and 1 mi. W Robertson, 8,700 ft., 5; 11½ mi. S and 2 mi. E Robertson, 9,200 ft., 1; 2 mi. E and

12 mi. S Robertson, Ashley Nat. Forest, 1; 13 mi. S and 2 mi. E Robertson, 9,200 ft., 1.

Additional records (Howell 1929:95): *Uinta Co.:* Henry Fork, 5 mi. W Lone Tree; Lone Tree.

Eutamias umbrinus fremonti White

Eutamias umbrinus fremonti White, Univ. Kansas Publ., Mus. Nat. Hist. 5:575, December 1, 1953.

Type.—Male, adult, skull, skin, and baculum, No. 41790 (KU); from 31 mi. N Pinedale, 8,025 ft., Sublette County, Wyoming; obtained on July 8, 1951, by Rollin H. Baker; original No. 1596.

Diagnosis.—Size large; over-all tone of upper parts dark; lower tooth-row longest of this species in Wyoming.

Description.—Color pattern: Crown Cinnamon-Buff mixed with gray; upper facial stripe Sepia; ocular stripe Chaetura-Drab; submalar stripe Fuscous Black mixed with Sayal Brown; ears black; anterior margin of ear Mars Yellow; posterior margin of ear grayish white; hairs inside posterior part of pinna Dresden Brown; postauricular patch Pale Smoke Gray; median dorsal dark stripe black; lateral dorsal dark stripes black mixed with Sayal Brown; outermost dorsal dark stripes Buckhorn Brown mixed with black or sometimes absent; median pair of dorsal light stripes grayish mixed with Buckhorn Brown; outer pair of dorsal light stripes creamy white; sides Buckhorn Brown; rump and thighs Pale Smoke Gray mixed with Saccardo's Umber; dorsal surface of tail black mixed with Buckhorn Brown; ventral surface of tail Sayal Brown, with Fuscous Black around margin and white or Light Buff around outermost edge; antipalmar and antiplantar surfaces of feet Warm Buff; underparts creamy white with dark underfur. *Skull:* Large; zygomata strong and arched; braincase well inflated. *Baculum:* Broad at base; shaft tapers sharply to tip.

Comparisons.—From *E. u. montanus,* the subspecies from the Medicine Bow Range of south-central Wyoming, *E. u. fremonti* differs in: Over-all tone of upper parts darker; underside of tail darker; feet darker; sides darker.

For comparisons with *E. u. umbrinus* see the account of that subspecies.

Remarks.—This subspecies normally occurs in the forest as do the other subspecies of *E. umbrinus* in Wyoming. A single specimen taken at 12 mi. N and 3 mi. W Shoshoni, Fremont County, is the exception which probably indicates that *E. umbrinus* does occur outside of its normal habitat and that gene-flow exists between the subspecies of this species.

Specimens examined.—Total number, 53.

Yellowstone Park: Unspecified, 2.

Park Co.: Beartooth Lake, 1 (BS); 16¼ mi. N and 17 mi. W Cody, 5,625 ft., 2.

Teton Co.: 1 mi. E and ¼ mi. N Togwotee Pass, 9,800 ft., 2; Amphitheater Lake, Teton Park, 1 (MM); Flat Creek, 4 (MM); head of Cache Creek, 4 (MM); Jackson, Upper Arizona Creek, 2 (MM); Flat Creek-Granite Creek divide, 6 (MM); Flat Creek Pass, 1 (MM); Flat Creek-Gravel Creek divide, 2 (MM).

Lincoln Co.: La Barge Creek, near source, 9,000 ft., 1 (BS).

Fremont Co.: Togwotee Pass, 12 (FC); 12 mi. N and 3 mi. W Shoshoni, 4,650 ft., 1; Mosquito Park R. S., 9,500 ft., 17½ mi. W and 2½ mi. N Lander, 1; 17 mi. S and 6½ mi. W Lander, 8,450 ft., 3.

Sublette Co.: 31 mi. N Pinedale, 8,025 ft., 1; W side Barbara Lake, 10,300 ft., 8 mi. S and 3 mi. W Fremont Peak, 4; 19 mi. W and 2 mi. S Big Piney, 7,700 ft., 5.

Additional records (Howell 1929:95): *Park Co.:* Near head of Clark Fork; Whirlwind Peak near Pahaska, N Fork Shoshone River; Valley, Shoshone Mountains; Needle Mountain. *Teton Co.:* Teton Mountains, S Moose Creek. *Lincoln Co.:* Salt River Mountains. *Sublette Co.:* Gros Ventre Range, 12 mi. NW Kendall; Merna; 8 mi. W Stanley; Big Sandy. *Fremont Co.:* Jackey's Creek, 4 mi. SW Dubois; Bull Lake, Wind River Mountains; Lake Fork, Wind River Mountains; Fremont Peak.

Eutamias umbrinus montanus White

Eutamias umbrinus montanus White, Univ. Kansas Publ. Mus. Nat. Hist. 5:576, December 1, 1953.

Type.—Male, adult, skull, skin, and baculum; 20105 (KU); from ½ mi. E and 3 mi. S Ward, 9,400 ft., Boulder County, Colorado; obtained on August 1, 1947, by E. L. Cockrum; original No. 721.

Diagnosis.—Size large; over-all tone of upper parts light; sides light.

Description.—Color pattern: Crown Raw Sienna mixed with gray; upper facial stripe and ocular stripe black mixed with Sepia; submalar stripe Snuff Brown mixed with black; ear black or Sepia; anterior margin of ear Ochraceous-Tawny; posterior margin of ear and postauricular patch grayish white; hairs inside posterior part of pinna Cinnamon-Buff; median dorsal dark stripe black with Sayal Brown along margins; lateral pair of dorsal dark stripes black mixed with Sayal Brown; outermost pair of dorsal dark stripes Sayal Brown mixed with black or sometimes lacking; median pair of dorsal light stripes Pale Smoke Gray mixed with Clay Color; outer pair of dorsal light stripes creamy white; sides Clay Color; rump and thighs Neutral Gray; dorsal surface of tail black mixed with Cinnamon-Buff; ventral surface of tail Ochraceous-Tawny, with black along margin and Cinnamon-Buff or Ochraceous-Tawny along outermost edge; antipalmar and antiplantar surfaces of feet Cinnamon-Buff; underparts creamy white with dark underfur. *Skull:* Large; zygomata strong and arched; braincase well-inflated. *Baculum:* Broad at base; shaft tapers sharply to tip.

Comparisons.—For comparisons with *E. u. umbrinus* and *E. u. fremonti*, see the accounts of those subspecies.

Remarks.—Although in Wyoming this subspecies is known only from the Medicine Bow Range, one would expect to find it occurring in the Snowy Range and the Laramie Range as well, since there seems to be suitable habitat for this subspecies in those mountain ranges.

Specimens examined.—Total number, 3.

Albany Co.: 3 mi. ESE Browns Peak, 10,000 ft., 2; 3½ mi. S Wood's Landing, 1.

REVIEW AND CONCLUSIONS

Eutamias minimus in Wyoming is divisible into two size-groups of subspecies; the smaller size-group (*E. m. minimus* and *E. m. consobrinus*), which occurs in the western part of the State, is significantly smaller, in measurements of the skull and baculum, than the larger size-group (*E. m. pallidus, E. m. confinis, E. m. silvaticus,* and *E. m. operarius*) which occurs in the eastern part of the State.

Although all the six subspecies of *E. minimus* in Wyoming can be differentiated from one another by color pattern, this species cannot be divided, by means of color pattern, into two groups, comparable in geographic range, to the two size-groups that were established above on the basis of variations in the skull and baculum.

Thus, the subspecies of *E. minimus* are morphologically differentiated at two distinct levels; one level is based on differences in the skull and baculum, while the other is based on differences in color.

Although there is considerable controversy concerning the glacial chronology in the mountains of western North America (Flint 1947:302-303), it is generally agreed that in Wyoming, in Wisconsinan time (the latest glacial age), glaciers covered a large part of the Yellowstone-Teton-Wind River highlands, the Big Horn Mountains, the southern part of the Laramie Range, the Medicine Bow Range, Sierra Madre Range, and the northern foothills of the Uinta Mountains. With this in mind, a possible explanation of the geographic variation in *E. minimus* of Wyoming, is here attempted.

In Sangamonian time, *E. minimus*-like chipmunks occurred over most of the region which is now Wyoming, and were divided into two size-groups, much as *E. minimus* is today.

When permanent snow fields were formed in Wisconsinan time, these chipmunks were restricted in their ranges, not, of course, occurring on the glaciers.

When the glaciers melted at the end of Wisconsinan time, new habitats were thus "uncovered." The chipmunks which moved in to these ice-free areas, then, became adapted to the new habitats. This then accounts for the subspeciation of *E. m. consobrinus, E. m. confinis,* and *E. m. operarius.*

The Black Hills were not covered by glaciers. In late Pleistocene time these hills were probably of low relief. Subsequent differential erosion produced relief sufficient to provide a different habitat. The

chipmunks that continued to occupy this area adapted themselves in color to the new habitat and became *E. m. silvaticus.*

Literature Cited

Cary, M.

1917. Life zone investigations in Wyoming. N. Amer. Fauna, 42:1-96, 15 pls., 17 figs.

Flint, R. F.

1947. Glacial geology and the Pleistocene Epoch. John Wiley and Sons, New York, pp. xviii + 589, 88 figs., 27 tables, 6 pls.

Hall, E. R.

1926. Changes during growth in the skull of the rodent Otospermophilus grammurus beecheyi. Univ. California Publ. Zool., 21:355-404, 43 figs., March 9.

———

1946. Mammals of Nevada. Univ. California Press, Berkeley, California, pp. xi + 710, 11 pls., 485 figs., July 1.

Howell, A. H.

1929. Revision of the American chipmunks (genera *Tamias* and *Eutamias*). N. Amer. Fauna, 52:1-157, 10 pls., 9 maps, November 30.

Johnson, D. H.

1943. Systematic review of the chipmunks (genus Eutamias) of California. Univ. California Publ. Zool., 48:63-148, 1 pl., 12 figs., December 24.

Larrison, E. J.

1949. Variation in the chipmunks of west-central Washington. Murrelet, 29:34-43, 1 map, March 1.

Shaw, W. T.

1944. Brood nests and young of two western chipmunks in the Olympic Mountains of Washington. Jour. Mamm., 25:274-284, 1 pl., 4 figs., September 8.

White, J. A.

1953. Taxonomy of the chipmunks, Eutamias quadrivittatus and Eutamias umbrinus. Univ. Kansas Publ., Mus. Nat. Hist., 5:563-582, 6 figs. in text, December 1.

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The Baculum in the Chipmunks of Western North America

BY

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Introduction

The baculum is the bony part of the penis. In the species of the subgenus *Neotamias* the proximal part of the baculum is termed the shaft, and the distal upturned part is termed the tip. On the dorsal side of the tip there is a longitudinal ridge termed the keel. The proximal end of the shaft is termed the base (see fig. 19). Depending on the species, the shaft varies from 2.11 to 5.28 mm. in length, and the base may or may not be widened or deepened.

The purpose of this report is to: (1) Show the usefulness of the structure of the baculum as a taxonomic character in chipmunks;

and (2) compare a classification based on the structure of the baculum with a classification based on the structure and appearance of the skull and skin.

Methods, Materials, and Acknowledgments

The bacula which were borrowed from the University of Michigan, Museum of Zoology, were processed according to the method described by Friley (1947:395-397), whereas all others were processed according to the method described by White (1951:125). Thus the bacula that were borrowed from the University of Michigan, are maintained there in a separate collection, whereas the bacula borrowed from other museums and those that are at the University of Kansas, Museum of Natural History, are housed with the skulls of the corresponding specimens.

All measurements of the bacula were made by means of an eyepiece micrometer.

A total of 194 bacula were seen. All of these are in the Museum of Natural History of the University of Kansas, unless otherwise indicated by the following symbols:

BS . . . United States Biological Surveys Collection.
CN . . Chicago Natural History Museum.
LA . . . Los Angeles County Museum.
MM . . University of Michigan, Museum of Zoology.
NM . . United States National Museum.
UU . . . University of Utah, Museum of Zoology.

I am grateful to Professor E. Raymond Hall for guidance in my study and thank Drs. Robert W. Wilson, Keith R. Kelson, and Edwin C. Galbraith, as well as other friends and associates of the Museum of Natural History, University of Kansas, for encouragement and valuable suggestions. Dr. William L. Jellison, United States Public Health Service, aided me in part of my field work and kindly sent me some specimens of chipmunks. My wife, Alice M. White, made the illustrations and helped me in many ways.

For the loan of bacula I thank Dr. William H. Burt, University of Michigan, Museum of Zoology. For permission to search for bacula on study skins, and to process those that were found, I thank Miss Viola S. Schantz, United States Fish and Wildlife Service, Mr. Colin C. Sanborn, Chicago Natural History Museum, Mr. Kenneth E. Stager, Los Angeles County Museum, Dr. David H. Johnson, United States National Museum, and Dr. Stephen D. Durrant, Museum of Zoology, University of Utah.

Assistance with field work is acknowledged from the Kansas University Endowment Association, the National Science Foundation and the United States Navy, Office of Naval Research, through contract No. NR 161 791.

Variation

Individual variation.—Individual variation is small. This is shown by a coefficient of variability of only 3.85 in the length of the shaft in a series of 12 specimens of *E. umbrinus umbrinus* from Paradise Park, 21 mi. W and 15 mi. N Vernal, 10,050 ft., Uintah County, Utah.

Variation with age.—In the chipmunks the baculum varies but little with age. In the youngest specimens that I have taken, the M3 and m3 have not yet erupted and there is no wear on P4 and p4; nevertheless, the baculum in these specimens has nearly an adult configuration and size. In juvenal *Eutamias minimus* the tip of the baculum is longer in relation to the length of the shaft than it is in adults; the tip is 18 to 28 per cent of the length of the shaft in adults, as opposed to 29 to 32 per cent in juveniles.

Aberrations.—In a small percentage of specimens of *E. minimus* and *E. umbrinus* the baculum is small and S-shaped, even in adults.

Variations of taxonomic worth.—Variations in this category are described in the section immediately following the key.

KEY TO THE BACULA IN EUTAMIAS OF WESTERN NORTH AMERICA

1. Distal ½ to ⅔ of shaft markedly compressed laterally; base markedly widened.
   2. Distal ½ of shaft laterally compressed and curved downward to base of tip.
      3. Height of keel ½ of length of tip; keel markedly enlarged. *Eutamias bulleri*, p. 627
      3′. Height of keel ¼ of length of tip; keel not markedly enlarged. *Eutamias umbrinus* and *E. palmeri*, pp. 626, 627
   2′. Distal ⅔ of shaft laterally compressed and curved downward to base of tip.
      4. Base of keel ⅓ of length of tip; angle formed by tip and shaft less than 100° ..... *Eutamias speciosus*, p. 625
      4′. Base of keel ½ of length of tip; angle formed by tip and shaft more than 102° ..... *Eutamias panamintinus*, p. 625
1′. Distal 1/12 to ⅖ of shaft slightly compressed laterally; base not markedly widened.
   5. Shaft thin; shaft less than .20 mm. in diameter at widest point.
      6. Ridges on either side of keel enlarged, partially obscuring lateral view of keel; height of keel 1/10 of length of tip. *Eutamias sonomae*, p. 619
      6′. Ridges on either side of tip not enlarged, not partially obscuring lateral view of keel; height of keel at least 1/7 of length of tip.
         7. Base not widened or dorsoventrally thickened.
            8. Shaft more than 4.5 mm. in length; tip 16 per cent of length of shaft; shaft strongly incised on dorsal side of base ..... *Eutamias merriami*, p. 621
            8′. Shaft less than 4.4 mm. in length; tip more than 25 per cent of length of shaft; shaft not incised on dorsal side of base.
               9. Height of keel 1/7 of length of tip; angle formed by tip and shaft distinct ..... *Eutamias alpinus*, p. 616

9′. Height of keel at least ⅕ of length of tip; angle formed by tip and shaft poorly defined.
10. Height of keel ⅓ of length of tip; angle formed by tip and shaft 140°..... *Eutamias dorsalis*, p. 620
10′. Height of keel ⅕ of length of tip; angle formed by tip and shaft 130° or less.
11. Tip more than 29 per cent of length of shaft. *Eutamias amoenus*, p. 619
11′. Tip less than 28 per cent of length of shaft. *Eutamias minimus*, p. 617
7′. Base widened and dorsoventrally thickened. *Eutamias townsendii*, p. 618
5′. Shaft thick; shaft more than .25 mm. in diameter at widest point.
12. Length of shaft less than 3.00 mm.; length of tip less than 1.10 mm..... *Eutamias quadrivittatus hopiensis*, p. 622
12′. Length of shaft more than 3.10 mm.; length of tip more than 1.15 mm.
13. Tip less than 28 per cent of length of shaft. *Eutamias quadrimaculatus*, p. 624
13′. Tip more than 29 per cent of length of shaft.
14. Angle formed by tip and shaft more than 140°; ridges on either side of tip indistinct. *Eutamias cinereicollis*, p. 624
14′. Angle formed by tip and shaft less than 135°; ridges on either side of tip distinct.
15. Shaft less than 3.65 mm. in length, and .55 mm. or less in diameter at widest point. *Eutamias quadrivittatus quadrivittatus*, p. 621
15′. Shaft usually more than 3.65 mm. in length, but when shorter, diameter is .60 mm. or more at widest point.
16. Diameter of shaft at widest point less than .58 mm.; tip less than 35 per cent of length of shaft. *Eutamias ruficaudus ruficaudus*, p. 622
16′. Diameter of shaft at widest point more than .65 mm.; tip more than 40 per cent of length of shaft.. *Eutamias ruficaudus simulans*, p. 623

Accounts by Species

Eutamias alpinus (Merriam)

Figure 1

Pelage silky; tail bright orange beneath; markings relatively obscure; size small; skull broad, flattened, and large in proportion to body.

Baculum: Shaft thin; keel low, ⅐ of length of tip; tip 39 per cent of length of shaft; angle formed by tip and shaft 135°; distal ⅓ of shaft slightly compressed laterally; base slightly wider than shaft; shaft short, 2.17 mm.

Differs from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in base not markedly widened, and shaft thinner; from *E. quadrivittatus, E. ruficaudus, E. cinereicollis,* and *E. quadrimaculatus,* in shaft thinner, baculum shorter; from *E. townsendii,* in base not dorsoventrally thickened, base not so widened; from *E. sonomae,* in ridges on either side of tip not enlarged, base not dorsoventrally thickened; from *E. amoenus, E. minimus,* and *E. dorsalis,* in keel lower, angle formed by tip and shaft more distinct; from *E. merriami,* in baculum markedly shorter, base not incised dorsally.

Specimen examined: One from Big Cottonwood Meadows, S of Mount Whitney, 10,000 ft., Inyo Co., California (CN).

Eutamias minimus (Bachman)

Figure 2

Coloration varying from light to dark depending on subspecies; size small to medium; rostrum short and stout.

Baculum: Shaft thin; keel low, ⅕ of length of tip; tip 18 to 28 per cent of length of shaft; angle formed by tip and shaft 125°; distal ½ of shaft slightly compressed laterally; shaft short to long, 2.44 to 4.35 mm.

Differs from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in shaft thinner, base not markedly widened; from *E. quadrivittatus, E. ruficaudus, E. cinereicollis,* and *E. quadrimaculatus,* in shaft thinner, tip shorter; from *E. amoenus,* in tip less than 28 per cent of length of shaft; from *E. dorsalis,* in angle formed by tip and shaft smaller; from *E. townsendii,* in tip less than 28 per cent of length of shaft, angle formed by tip and shaft 125° instead of 130°; from *E. sonomae,* in ridges on either side of tip less well-developed, keel higher; from *E. merriami,* in shaft shorter (less than 4.40 mm.), base not incised, tip proportionally longer.

For comparison with *E. alpinus* see the account of that species.

In most places where *E. minimus* and *E. amoenus* occur together they can be distinguished without recourse to the baculum, but at Banff and Canmore in western Alberta, recourse to the baculum is almost necessary. There, as elsewhere, they can be distinguished readily by the shape of the bacula.

Specimens examined: 72.

Eutamias minimus borealis: Alberta: Canmore, 1 (BS).

E. m. cacodemus: South Dakota: *Shannon Co.:* Quinn's Draw, Cheyenne River, 1 (NM); 14 mi. N and 5 mi. W Rockyford, 3,200 ft., 1.

E. m. confinis: Wyoming: *Big Horn Co.:* 17 mi. E and 3 mi. S Shell, 9,000 ft., 1; 9 mi. E and 9 mi. N Tensleep, 8,200 ft., 1. *Washakie Co.:* 9 mi. E and 4 mi. N Tensleep, 7,000 ft., 1.

E. m. consobrinus: Montana: *Madison Co.:* 26 mi. NW West Yellowstone, 6,100 ft., 1. Wyoming: *Sublette Co.:* 5 mi. E and 9 mi. N Pinedale, 9,100 ft., 2. *Uinta Co.:* 10 mi. S and 1 mi. W Robertson, 8,700 ft., 1; 13 mi. S and 2 mi. E Robertson, 9,200 ft., 2. Utah: *Uintah Co.:* Paradise Park, 21 mi. W and 15 mi. N Vernal, 10,050 ft., 8. Colorado: *Jackson Co.:* 9½ mi. W and 2 mi. N Walden, 8,400 ft., 1.

E. m. jacksoni: Michigan: *Menominee Co.:* 7 mi. E Stephenson, 4 (MM). Wisconsin: *Juneau Co.:* Camp Douglas, 1 (NM).

E. m. minimus: Wyoming: *Natrona Co.:* 27 mi. N and 1 mi. E Powder River, 6,075 ft., 1; 16 mi. S and 11 mi. W Waltman, 6,950 ft., 1; Sun Ranch, 5 mi. W Independence Rock, 6,000 ft., 1. *Uinta Co.:* 8½ mi. W Ft. Bridger, 7,100 ft., 1; 2 mi. W Ft. Bridger, 6,700 ft., 1; unspecified, 3 (MM). *Sweetwater Co.:* Kinney Ranch, 21 mi. S Bitter Creek, 6,800 ft., 1; 32 mi. S and 22 mi. E Rock Springs, 7,025 ft., 3; 33 mi. S Bitter Creek, 1.

E. m. operarius: Wyoming: *Converse Co.:* 21½ mi. S and 24½ mi. W Douglas, 1. *Carbon Co.:* 8 mi. N and 19½ mi. E Savery, 8,800 ft., 1; 5 mi. N and 5 mi. E Savery, 6,900 ft., 1. *Albany Co.:* 3 mi. ESE Browns Peak, 10,000 ft., 1. Colorado: *Rocky Mountain National Park,* 1 (MM). *Boulder Co.:* Unspecified, 1 (NM). *Gunnison Co.:* 7 mi. S and 7 mi. W Gunnison, 8,150 ft., 1. *Saguache Co.:* 5 mi. N and 22 mi. W Saguache, 10,000 ft., 2. *Archuleta Co.:* Unspecified, 1 (MM); 5 mi. S and 25 mi. W Antonito, 9,600 ft., 3. *Costilla Co.:* Unspecified, 1 (MM). New Mexico: *Taos Co.:* 23 mi. S and 6 mi. E Taos, 8,750 ft., 3.

E. m. pallidus: Montana: *Fergus Co.:* Unspecified, 1 (MM). *Sweetgrass Co.:* Unspecified, 1 (MM). Wyoming: *Campbell Co.:* 4 mi. S and 3 mi. W Rockypoint, 1; Ivy Creek, 8 mi. W and 5 mi. N Spotted Horse, 3; Middle Butte, 6,010 ft., 38 mi. S and 19 mi. W Gillette, 1.

E. m. silvaticus: South Dakota: *Pennington Co.:* Unspecified, 1 (MM). *Custer Co.:* Unspecified, 2 (MM). Wyoming: *Weston Co.:* 1½ mi. E Buckhorn, 6,150 ft., 3.

Eutamias townsendii (Bachman)

Figure 3

Pelage tawny to olivaceous; stripes obscure and underparts tawny, or stripes conspicuous and underparts white; tail slender and sparsely haired; size large; skull largest in the subgenus *Neotamias.*

Baculum: Shaft thin; keel low, ⅛ of length of tip; tip 32 per cent of length of shaft; angle formed by tip and shaft 130°; distal ⅛ of shaft slightly compressed laterally; base deeper and wider than shaft; shaft short, 2.24 mm.

Differs from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in base not markedly widened, shaft thinner, tip proportionally shorter; from *E. quadrivittatus, E. ruficaudus, E. cinereicollis,* and *E. quadrimaculatus,* in shaft thinner, baculum shorter and smaller; from *E. sonomae,* in ridges on either side of tip not enlarged, keel proportionally higher; from *E. amoenus* and *E. dorsalis,* in base widened and thickened, baculum usually shorter;

from *E. merriami*, in being markedly shorter, and having base widened and deepened but not incised dorsally.

For comparisons with *E. alpinus* and *E. minimus* see the accounts of those species.

Specimens examined: 2.

E. townsendii townsendii: Oregon: *Multnomah Co.:* Portland, 1 (NM).

E. t. cooperi: Oregon: *Hood Co.:* Brooks Meadow, 4,300 ft., 9 mi. ENE Mount Hood, 1.

Eutamias sonomae Grinnell

Figure 4

Upper parts rich reddish, more or less dulled by gray; backs of pinnae of ears nearly bare; tail long and bushy; size large; skull large, long, and narrow; rostrum deep.

Baculum: Shaft thin; keel low, 1/10 of length of tip; tip 27 to 31 per cent of length of shaft; angle formed by tip and shaft 130°; distal ¼ of shaft slightly compressed laterally; base deeper and wider than shaft; shaft of medium length, 3.03 to 3.30 mm.; ridges on either side of tip strongly developed, partly obscuring keel from side.

Differs from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in ridges on either side of tip strongly developed, shaft thin, base not markedly widened, tip proportionally shorter; from *E. quadrivittatus, E. ruficaudus, E. cinereicollis,* and *E. quadrimaculatus,* in shaft thin, ridges on either side of tip strongly developed, baculum shorter; from *E. amoenus* and *E. dorsalis,* in keel lower, ridges on either side of tip strongly developed, base thicker and wider; from *E. merriami,* in markedly shorter, ridges on either side of tip strongly developed, tip proportionally longer, base wider and deeper but not incised dorsally.

For comparisons with *E. alpinus, E. minimus,* and *E. townsendii,* see the accounts of those species.

Specimens examined: 5.

E. sonomae alleni: California: *Marin Co.:* Unspecified, 1 (NM).

E. sonomae sonomae: California: *Siskiyou Co.:* Salmon Mts., W slope, W of Etna, 1 (BS). *Shasta Co.:* Redding, 1 (BS). *Mendocino Co.:* Cahto, 1 (BS).

Eutamias amoenus (J. A. Allen)

Figure 5

Upper parts generally ochraceous; venter frequently buffy; size small to medium; zygomatic arches usually appressed to cranium; frequently difficult to distinguish from *E. minimus.*

Baculum: Shaft thin; keel low, ⅛ of length of tip; tip 30 to 35 per cent of length of shaft; angle formed by tip and shaft 130°;

distal ⅛ of shaft slightly compressed laterally; shaft short, 2.37 to 2.96 mm.

Differs from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in base not markedly widened, shaft thinner; from *E. quadrivittatus, E. ruficaudus, E. cinereicollis* and *E. quadrimaculatus,* in shaft thinner, baculum usually shorter, tip shorter; from *E. dorsalis,* in keel lower, angle formed by tip and shaft 130°, usually smaller; from *E. merriami,* in being markedly shorter, and in base not being dorsally incised, tip proportionally longer.

For comparisons with *E. alpinus, E. minimus, E. townsendii,* and *E. sonomae,* see the accounts of those species.

Bacula from skins labeled as *E. amoenus amoenus* from, Lardo, Valley Co., Idaho (MM), Butte Co., Idaho (MM), and Boise National Forest, Idaho (BS), resemble the bacula of *E. umbrinus,* and critical study of other features of these specimens probably will show that they are *E. umbrinus.*

Specimens examined: 23.

E. amoenus amoenus: Oregon: *Klamath Co.:* Fort Klamath, 1 (MM). Idaho: *Valley Co.:* Lardo, 1 (BS). *Butte Co.:* Unspecified, 1 (MM). Boise National Forest, 1 (BS).

E. a. ludibundus: British Columbia: Moose Lake, 1 (NM).

E. a. luteiventris: Alberta: Banff, 2 (BS). Montana: *Flathead Co.:* 1 mi. W and 2 mi. S Summit, 5,000 ft., 1. *Teton Co.:* 17⅛ mi. W and 6½ mi. N Augusta, 5,100 ft., 2. *Missoula Co.:* Unspecified, 1 (MM). Idaho: *Idaho Co.:* 20 mi. S and 2 mi. E Grangeville, 2. *Fremont Co.:* 7 mi. W West Yellowstone, 7,000 ft., 5; 9 mi. SW West Yellowstone, 8,500 ft., 1. Wyoming: *Teton Co.:* 2½ mi. N and 3½ mi. E Moran, 7,225 ft., 1.

E. a. monoensis: California: *Mono Co.:* Leevining Creek, 1 (NM).

E. a. vallicola: Montana: *Ravalli Co.:* Bass Creek, 3½ mi. NW Stevensville, 3,750 ft., 2.

Eutamias dorsalis (Baird)

Figure 6

General tone of upper parts smoky gray; dorsal stripes indistinct or obsolete; skull large.

Baculum: Shaft thin; keel low, ⅛ of length of tip; tip 29 to 40 per cent of length of shaft; angle formed by tip and shaft 140°; distal ½ of shaft slightly compressed laterally; shaft short to medium, 2.64 to 3.69 mm.

Differs from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in base not widened, shaft thinner; from *E. quadrivittatus, E. ruficaudus, E. cinereicollis,* and *E. quadrimaculatus,* in shaft thinner, baculum usually shorter; from *E. merriami,* in shaft markedly shorter, base not incised dorsally, tip proportionally longer.

For comparisons with *E. alpinus, E. minimus, E. townsendii, E. sonomae,* and *E. amoenus,* see the accounts of those species.

Specimens examined: 12.

E. dorsalis dorsalis: Arizona: *Yavapai Co.:* 3 mi. N Ft. Whipple, 5,000 ft., 1 (BS). *Gila Co.:* Carr's Ranch, Sierra Ancha Mountains, 1 (BS). *Pima Co.:* Unspecified, 1 (MM). New Mexico: *Valencia Co.:* Mount Taylor, 1 (MM); 1 mi. N Cebolleta, 1 (MM). *Socorro Co.:* San Mateo Mountains, 1 (BS). *Chihuahua:* Sierra Madre, near Guadalupe y Calvo, 3 (BS).

E. d. utahensis: Wyoming: *Sweetwater Co.:* W side Green River, 1 mi. N Utah Border, 1. Colorado: *Moffat Co.:* Escalante Hills, 20 mi. SE Ladore, 1 (BS). Arizona: *Coconino Co.:* Ryan, 1 (BS).

Eutamias merriami (J. A. Allen)

Figure 7

General tone of upper parts grayish; cheeks and underparts white, more or less dulled by gray; size large; skull large.

Baculum: Shaft thin; keel low, ⅝ of length of tip; tip 16 per cent of length of shaft; angle formed by tip and shaft 130°; distal 1/10 of shaft slightly compressed laterally; base incised dorsally; shaft markedly long, 4.88 mm.

Differs from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in base incised dorsally, base not widened, shaft thinner, tip proportionally shorter; from *E. quadrivittatus, E. ruficaudus, E. cinereicollis,* and *E. quadrimaculatus,* in base incised dorsally, shaft thinner, tip proportionally much shorter.

For comparisons with *E. alpinus, E. minimus, E. townsendii, E. sonomae, E. amoenus,* and *E. dorsalis,* see the accounts of those species.

Specimens examined: One from Mount Piños, Ventura Co., California (LA).

Eutamias quadrivittatus (Say)

Figures 8-10

Color bright and tawny; size medium to large; braincase widened.

Baculum of *E. q. quadrivittatus:* Shaft thick; keel proportionally low, ¼ of length of tip; tip 30 to 44 per cent of length of shaft; angle formed by tip and shaft 130°; distal ⅓ of shaft slightly compressed laterally; shaft long, 3.17 to 3.62 mm.

Differs from *E. q. hopiensis,* in baculum larger, angle formed by tip and shaft less distinct; from *E. ruficaudus ruficaudus,* in shaft and tip proportionally shorter; from *E. r. simulans,* in keel proportionally lower, shaft usually shorter and narrower; from *E. cinereicollis,* in shaft shorter, angle formed by tip and shaft larger, ridges on either side of tip more distinct; from *E. quadrimaculatus,* in tip proportionally shorter, shaft shorter; from *E. speciosus, E. pana-*

mintinus, E. umbrinus, E. palmeri, and *E. bulleri,* in base not markedly widened, shaft longer, angle formed by tip and shaft larger.

For comparisons with *E. alpinus, E. minimus, E. townsendii, E. sonomae, E. amoenus, E. dorsalis,* and *E. merriami,* see the accounts of those species.

Baculum of *E. q. hopiensis:* Shaft thick; keel proportionally low, ⅓ of length of tip; tip 34 per cent of length of shaft; angle formed by tip and shaft 130°; distal ⅓ of shaft slightly compressed laterally; shaft short, 2.64 mm. in length.

Differs from *E. ruficaudus ruficaudus, E. r. simulans, E. cinereicollis,* and *E. quadrimaculatus,* in being shorter, proportions as in *E. q. quadrivittatus;* from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in base not markedly widened, angle formed by tip and shaft larger; from *E. alpinus, E. minimus, E. townsendii, E. sonomae, E. amoenus, E. dorsalis,* and *E. merriami,* except for smaller size, as in *E. q. quadrivittatus.*

Bacula of *E. q. hopiensis* from northeastern Arizona are like those in typical *E. q. quadrivittatus.* The specimens from this region, to judge from parts of the animal other than the baculum, are intergrades between *E. q. hopiensis* and *E. q. quadrivittatus.* Specimens from near Moab, Grand Co., Utah, are typical *E. q. hopiensis* and the bacula of these specimens are considerably smaller than those of specimens of typical *E. q. quadrivittatus.* No bacula are known to me that are structurally intermediate between those of *E. q. quadrivittatus* and *E. q. hopiensis.*

Specimens examined: 21.

E. quadrivittatus quadrivittatus: Colorado: *Gunnison Co.:* Sapinero, 1 (BS). *Chaffee Co.:* Unspecified, 1 (MM). *Saguache Co.:* 5 mi. N and 22 mi. W Saguache, 10,000 ft., 1. *Fremont Co.:* Canon City, 3 (BS). New Mexico: *Rio Arriba Co.:* Dulce, 1 (BS). *Taos Co.:* 23 mi. S and 6 mi. E Taos, 8,750 ft., 4. *Union Co.:* Sierra Grande, 1 (BS). *Valencia Co.:* Mirror Spring, Mt. Taylor, 3 (MM). *Torrance Co.:* S end, E slope, Manzano Mountains, 2 (BS).

E. quadrivittatus hopiensis: Utah: *Grand Co.:* Mouth of Nigger Bill Canyon, E side Colorado River, 4 mi. N Moab Bridge, 4,500 ft., 1 (UU); Moab, 4,500 ft., 1 (UU). Arizona: *Apache Co.:* Tunicha Mountains, 1 (BS).

Eutamias ruficaudus Howell

Figures 11-12

General tone of upper parts dark tawny; size medium; braincase narrowed.

Baculum of *E. r. ruficaudus:* Shaft thick; keel proportionally low, ¼ of length of tip; tip 31 to 33 per cent of length of shaft; angle

formed by tip and shaft 120°; distal ⅔ of shaft slightly compressed laterally; base slightly widened; shaft long, 4.09 to 4.56 mm.

Differs from *E. r. simulans,* in keel proportionally lower, tip proportionally shorter, distal ⅓ of shaft less laterally compressed, shaft usually longer; from *E. cinereicollis,* in angle formed by tip and shaft smaller, shaft shorter, ridges on either side of tip distinct; from *E. quadrimaculatus,* in tip proportionally longer, shaft usually shorter; from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in base not markedly widened, shaft longer, angle formed by tip and shaft larger.

For comparisons with *E. alpinus, E. minimus, E. townsendii, E. sonomae, E. amoenus, E. dorsalis, E. merriami,* and *E. quadrivittatus,* see the accounts of those species.

Baculum of *E. r. simulans:* Shaft thick; keel proportionally low, ⅔ of length of tip; tip 40 to 48 per cent of length of shaft; angle formed by tip and shaft 130°; distal ⅔ of shaft laterally compressed; base slightly wider than shaft; shaft medium to long, 3.30 to 4.26 mm.

Differs from *E. cinereicollis* in, keel proportionally higher, shaft shorter, tip proportionally longer, angle formed by tip and shaft smaller, distal ⅔ of shaft more laterally compressed; from *E. quadrimaculatus* in, keel proportionally higher, angle formed by tip and shaft larger, tip proportionally longer, distal ⅔ of shaft more laterally compressed, shaft shorter; from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in base not markedly widened, shaft usually longer.

For comparisons with *E. alpinus, E. minimus, E. townsendii, E. sonomae, E. amoenus, E. dorsalis, E. merriami,* and *E. quadrivittatus,* see the accounts of those species.

The differences between the bacula of the subspecies *Eutamias ruficaudus ruficaudus* and *E. r. simulans* are comparable to those usually found between species of chipmunks. Consequently, I suspect that *E. r. simulans* and *E. r. ruficaudus* are specifically distinct and suggest that a search would be worth while for specimens in the geographic area between the geographic ranges as now known for the two kinds to ascertain whether intergradation (the criterion of subspecies) occurs. I suppose there is no intergradation but in the absence of precise information, I choose not to modify the current taxonomic arrangement of *E. r. ruficaudus* and *E. r. simulans.*

Specimens examined: 17.

E. ruficaudus ruficaudus: Montana: *Flathead Co.:* 1 mi. W and 2 mi. S Summit, 5,000 ft., 2. *Ravalli Co.:* Big Hole Hill, 6,000 ft., 2; Big Hole Hill, 6,600 ft., 1; Continental Divide, Big Hole Hill, 7,000 ft., 1.

E. r. simulans: Idaho: *Bonner Co.:* Priest Lake, 1 (BS). *Kootenai Co.:* 13 mi. E and 5 mi. N Coeur d'Alene, 3. *Shoshone Co.:* Mullan, 1 (BS). *Clearwater Co.:* 25 mi. E and 16 mi. N Pierce, 6.

Eutamias cinereicollis (J. A. Allen)

Figure 13

General tone of upper parts dark grayish tawny; size medium to large; skull large; braincase widened.

Baculum: Shaft thick; keel proportionally low, ⅛ of length of tip; tip 34 per cent of length of shaft; angle formed by tip and shaft 145°; distal ⅓ of shaft slightly compressed laterally; base slightly widened; shaft long, 4.88 mm.

Differs from *E. quadrimaculatus,* in keel lower, ridges on either side of tip weakly developed, angle formed by tip and shaft larger; from *E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri,* in shaft longer, base not markedly widened, angle formed by tip and shaft much larger.

For comparisons with *E. alpinus, E. minimus, E. townsendii, E. sonomae, E. amoenus, E. dorsalis, E. merriami, E. quadrivittatus,* and *E. ruficaudus,* see the accounts of those species.

Specimen examined: One from Mount Thomas, White Mountains, Apache Co., Arizona (BS).

Eutamias quadrimaculatus (Gray)

Figure 14

General tone of upper parts bright reddish; pattern inconspicuous; light and dark facial stripes strongly contrasting; size large; skull relatively small and slightly built.

Baculum: Shaft thick; keel relatively low, ¼ of length of tip; tip 27 per cent of length of shaft; angle formed by tip and shaft 120°; distal ⅓ of shaft slightly compressed laterally; base slightly wider than shaft; shaft long, 4.35 to 5.28 mm.

Differs from *E. speciosus, E. panamintinus, E. townsendii, E. umbrinus, E. palmeri,* and *E. bulleri,* in shaft markedly longer; base not markedly widened; angle formed by tip and shaft larger; tip proportionally shorter.

For comparisons with all other species of chipmunks from western North America, see the accounts of those species.

Specimens examined: 4.

California: *Plumas Co.:* Mountains near Quincy, 1 (BS). *Placer Co.:* Blue Canyon, 1 (NM). *Alpine Co.:* Markleeville, 1 (BS); N fork Stanislaus River, 1 (BS).

Eutamias speciosus (Merriam)

Figure 15

General tone of upper parts bright; light and dark elements of color pattern strongly contrasting; outer stripes broad and strikingly conspicuous; size medium; skull moderately broadened; dorsal outline of skull strongly arched in profile; upper incisors short and sharply recurved.

Baculum: Shaft thick; keel of medium height, ⅓ of length of tip; base of keel ⅓ of length of tip; tip 47 to 55 per cent of length of shaft; angle formed by tip and shaft 90°; distal ⅔ of shaft markedly compressed laterally; base markedly wider than shaft; shaft short to medium, 2.11 to 3.17 mm.

Differs from *E. panamintinus,* in base of keel proportionally shorter, angle formed by tip and shaft smaller; from *E. umbrinus* and *E. palmeri,* in keel higher, angle formed by tip and shaft smaller, distal ⅔ (not ½) of shaft markedly laterally compressed, base markedly wider; from *E. bulleri,* in keel smaller, shaft shorter, tip proportionally longer, ridges on either side of tip distinct.

For comparisons with all other species of chipmunks of western North America, see the accounts of those species.

The baculum in *E. speciosus frater* is approximately the same size as in *E. umbrinus inyoensis,* but differs in shape as described above.

Specimens examined: 6.

E. speciosus frater: California: *Madera Co.:* San Joaquin River, near head of N fork, Sierra Nevada Mountains, 2 (BS).

E. speciosus sequoiensis: California: *Tulare Co.:* Mount Whitney, 1 (BS); Sequoia National Park, 2 (BS).

E. speciosus callipeplus: California: *Kern Co.:* Mount Pinos, 1 (BS).

Eutamias panamintinus (Merriam)

Figure 16

Dorsal dark stripes reddish; size small to medium; skull of medium size; braincase flattened.

Baculum: Shaft thick; keel low, ⅓ of length of tip; base of keel ½ of length of tip; tip 52 per cent of length of shaft; angle formed by tip and shaft 110°; distal ⅔ of shaft moderately compressed laterally; base markedly widened; shaft short, 2.17 mm.

Differs from *E. umbrinus* and *E. palmeri,* in distal ⅔ (rather than ½) of shaft moderately compressed laterally; from *E. bulleri,* in keel smaller, shaft shorter, ridges on either side of tip distinct.

For comparisons with other species of chipmunks of western North America, see the accounts of those species.

The structure of the baculum most closely resembles that of *E. speciosus* and the geographic ranges of these two species are in juxtaposition.

Specimen examined: One from Coal Kilns, Panamint Mountains, Inyo Co., California (CN).

Eutamias umbrinus (J. A. Allen)

Figures 17-18

General tone of upper parts dark; size medium to large; skull of medium size; braincase narrowed.

Baculum: Shaft thick; keel low, ¼ of length of tip; tip 36 to 50 per cent of length of shaft; angle formed by tip and shaft 100°; distal ½ of shaft markedly compressed laterally; base markedly widened; shaft short to medium, 2.51 to 3.03 mm.

Differs from *E. bulleri,* in shaft shorter, keel smaller, ridges on either side of tip distinct; distal ½ of shaft strongly compressed laterally. Does not differ from *E. palmeri.*

For comparisons with all other species of chipmunks of western North America, see the accounts of those species.

Specimens of *E. umbrinus montanus* from north-central Colorado have, in the past (Howell 1929:82), been referred to *E. quadrivittatus quadrivittatus.* In many features these two kinds of chipmunks resemble each other closely; their bacula, nevertheless, differ markedly (compare figs. 8-9 with 17-18).

Specimens examined: 25.

E. umbrinus umbrinus: Wyoming: *Uinta Co.:* 10 mi. S and 1 mi. W Robertson, 8,700 ft., 1. Utah: *Uintah Co.:* Paradise Park, 21 mi. W and 15 mi. N Vernal, 10,050 ft., 12.

E. u. adsitus: Utah: *Beaver Co.:* Britts Meadow, Beaver Range Mountains, 8,500 ft., 1 (BS). *Wayne Co.:* Donkey Lake, Boulder Mountain, 10,000 ft., 1 (UU). *Garfield Co.:* Wildcat R. S., Boulder Mountain, 8,700 ft., 1 (UU).

E. u. sedulus: Utah: *Garfield Co.:* Mount Ellen, Henry Mountains, 1 (BS).

E. u. inyoensis: California: *Tulare Co.:* Mount Whitney, head of Big Cottonwood Creek, 2 (BS). Nevada: *Elko Co.:* W side Ruby Lake, 3 mi. N Elko County Line, 1.

E. u. nevadensis: Nevada: *Clark Co.:* Sheep Mountains, 1 (MM).

E. u. fremonti: Wyoming: *Sublette Co.:* 31 mi. N Pinedale, 8,025 ft., 1; 19 mi. W and 2 mi. S Big Piney, 1.

E. u. montanus: Colorado: *Boulder Co.:* 3 mi. S Ward, 9,000 ft., 1; ½ mi. E and 3 mi. S Ward, 9,400 ft., 1.

Eutamias palmeri Merriam

Figures 17-18

General tone of upper parts grayish tawny; ocular stripe pale; skull, rostrum, nasals, and upper incisors shorter than in *E. umbrinus*.

Baculum: Indistinguishable from that of *E. umbrinus*. This supports the opinion of previous students that *E. palmeri* is a close relative of *E. umbrinus* which occurs immediately to the north and east. Intergradation does not occur between these two species, for, low-lying terrain, inhospitable to chipmunks, isolates *E. palmeri* from its relatives. (Verbal information from E. R. Hall.)

Specimen examined: One from Charleston Peak, 8,000 ft., Clear Creek Co., Nevada.

Eutamias bulleri (J. A. Allen)

Figure 19

General tone of upper parts dark; dorsal dark stripes conspicuous and black; size large; skull large.

Baculum: Shaft thick; keel high, ½ of length of tip; keel long, ½ of length of tip; tip 40 to 48 per cent of length of shaft; angle formed by tip and shaft 100°; base markedly widened; shaft of medium length, 3.30 mm.

For comparisons with all other species of chipmunks of western North America, see the accounts of those species.

The large size of the keel of the baculum in this species is distinctive among chipmunks of western North America.

Specimens examined: 2.

E. bulleri bulleri: Zacatecas: Sierra de Valparaiso, 2 (NM).

Figs. 1-19. Lateral view of right side, unless otherwise indicated, of the baculum in each of the species of chipmunks (subgenus *Neotamias*) of western North America:

1. *Eutamias alpinus,* No. 12577 CN; from Big Cottonwood Meadow, Tulare Co., California.

2. *E. minimus consobrinus,* No. 25439; from 13 mi. S and 2 mi. E Robertson, 9,200 ft., Uinta Co., Wyoming.

3. *E. townsendii cooperi,* No. 53169; from Brooks Meadow, 4,300 ft., 9 mi. ENE Mt. Hood, Hood River Co., Oregon.

4. *E. sonomae sonomae,* No. 98436 BS; from Redding, Shasta Co., California.

5. *E. amoenus luteiventris,* No. 33811; from 7 mi. W West Yellowstone, 7,000 ft., Fremont Co., Idaho.

6. *E. dorsalis dorsalis,* No. 213415 BS; from 3 mi. N Ft. Whipple, 5,000 ft., Yavapai Co., Arizona.

7. *E. merriami merriami,* No. 1270 LA; from Mount Pinos, Ventura Co., California.

8 and 9. *E. quadrivittatus quadrivittatus,* No. 35648/47919 BS; from Canon City, Fremont Co., Colorado. Figure 9 in dorsal view.

10. *E. quadrivittatus hopiensis,* No. 783 UU; from Moab, 4,500 ft., Grand Co., Utah.

11. *E. ruficaudus ruficaudus,* No. 33884; from 1 mi. W and 2 mi. S Summit, 5,000 ft., Flathead Co., Montana.

12. *E. ruficaudus simulans,* No. 41478; from 13 mi. E and 5 mi. N Coeur d'Alene, Kootenai Co., Idaho.

13. *E. cinereicollis cinereicollis,* No. 208621 BS; from Mount Thomas, White Mountains, Apache Co., Arizona.

14. *E. quadrimaculatus,* No. 95780 BS; from Mountains near Quincy, Plumas Co., California.

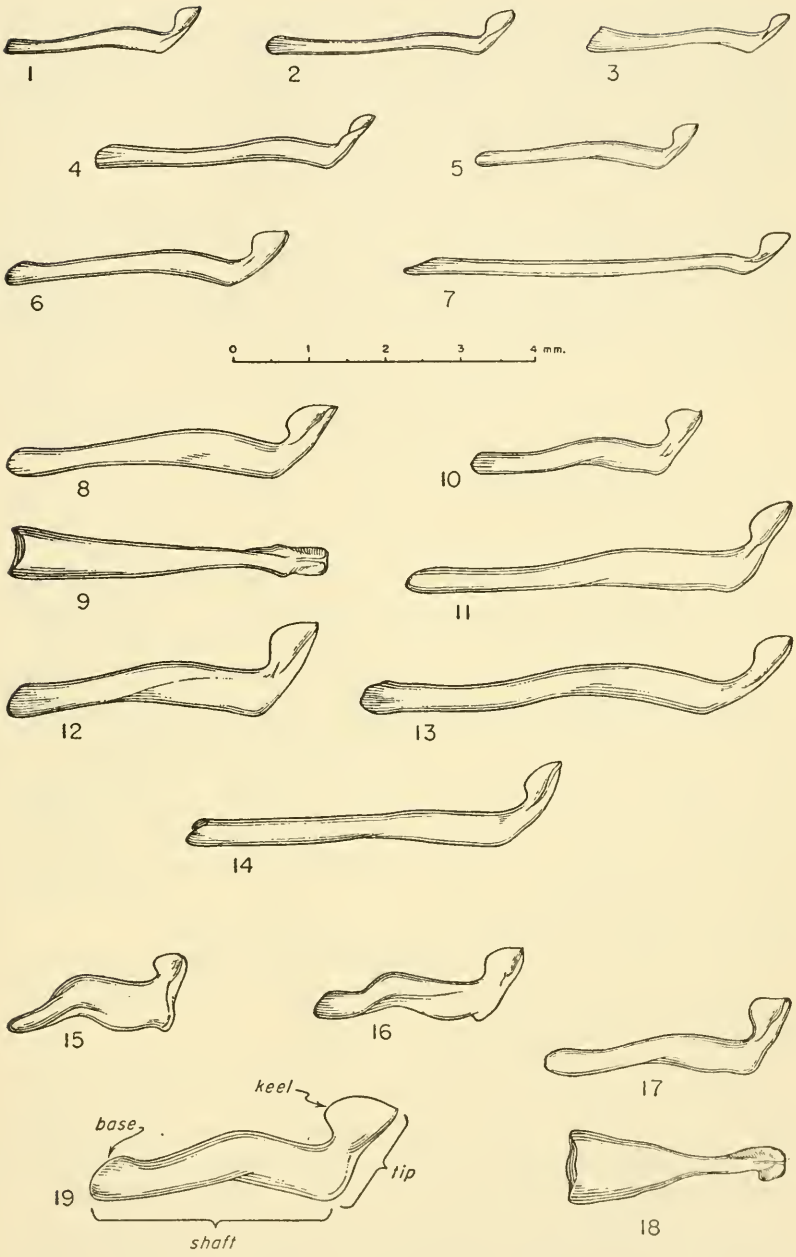
15. *E. speciosus sequoiensis,* No. 29135/41203 BS; from Mount Whitney, Tulare Co., California.

16. *E. panamintinus panamintinus,* No. 12502 CN; from Coal Kilns, Panamint Mountains, Inyo Co., California.

17. *E. umbrinus umbrinus,* No. 38062; from Paradise Park, 21 mi. W and 15 mi. N Vernal, 10,050 ft., Uintah Co., Utah.

18. *E. umbrinus montanus,* No. 20105; from ½ mi. E and 3 mi. S Ward, 9,400 ft., Boulder Co., Colorado. Dorsal view.

19. *E. bulleri bulleri,* No. 193142 NM; from Sierra del Valparaiso, Zacatecas.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Discussion

In California, Johnson (1943) recognized ten species of chipmunks and assigned these to the five main groups of species which were proposed by Howell (1929). In characterizing each species, Johnson (*op. cit.*) not only made a careful study of skins and skulls, but also employed many ecological data.

Study of the bacula of the Californian chipmunks supports Johnson's (*op. cit.*) conclusion that there are ten species, but suggests that there are three (not five) groups of species in California—as well as elsewhere within the geographic range of the subgenus *Neotamias*. The three groups are (see figs. 1-19): 1. *minimus*-group (*E. alpinus, E. minimus, E. townsendii, E. sonomae, E. amoenus, E. dorsalis,* and *E. merriami*); 2. *quadrivittatus*-group (*E. quadrivittatus, E. ruficaudus, E. cinereicollis,* and *E. quadrimaculatus*); and 3. *speciosus*-group (*E. speciosus, E. panamintinus, E. umbrinus, E. palmeri,* and *E. bulleri*).

Eutamias panamintinus, according to Howell (*op. cit.*:78) and Johnson (*op. cit.*:83), is a near relative of *E. amoenus*. But, the baculum in *E. panamintinus* more closely resembles that in *E. speciosus* than that in *E. amoenus* (compare figs. 5, 15, and 16). Consequently I have placed *E. panamintinus* in the *speciosus*-group.

In north-central Colorado, specimens that really are *E. umbrinus* (subspecies *montanus*) have, in the past (Howell *op. cit.*:82), been referred to *E. quadrivittatus quadrivittatus,* but the bacula of the two species differ markedly from each other (compare figs. 8-9 with 17-18) and permit the specimens readily to be correctly identified to species. Further, Howell (*op. cit.*:95) placed *E. umbrinus* (subspecies *umbrinus* and *fremonti* of current usage) in the *quadrivittatus*-group, whereas the structure of the baculum leads me to place *E. umbrinus* in the *speciosus*-group.

Thus, groups of species established on the basis of only skulls and skins, in a few instances differ from those established on a broader basis which includes the bacula.

Johnson (*op. cit.*:63) writes, "Each species [of Eutamias] has a characteristic habitat which differs from those of other species. Where two or more species occur together in a general locality they are usually mutually exclusive in their choice of foraging and nesting sites and in the time of breeding." Thus he classified the species of Californian chipmunks not only by morphologic characteristics but by habits and habitats as well. The characteristics of the skulls and skins of chipmunks probably reflect the habitats

in which these animals live. The characteristics of the bacula, on the other hand, may also reflect the habitats in which the animals live, but to a lesser degree. Because the structures of the bacula are probably less affected by the action of the external environment, they probably indicate relationships between groups of species of chipmunks more clearly than do characteristics of the skulls and skins.

If the structures of the bacula indicate relationships between groups of species of chipmunks more clearly than do the characteristics of the skulls and skins, the close resemblance of the skulls of *E. quadrivittatus* and *E. umbrinus* may be thought of as convergence. The same can be said of *E. amoenus* and *E. panamintinus.*

LITERATURE CITED

FRILEY, C. E., JR.
1947. Preparation and preservation of the baculum of mammals. Jour. Mamm., 28:395-397, 1 fig., December 1.

HOWELL, A. H.
1929. Revision of the American chipmunks (genera *Tamias* and *Eutamias*). N. Amer. Fauna, 52:1-157, 10 pls., 9 maps.

JOHNSON, D. H.
1943. Systematic review of the chipmunks (genus Eutamias of California. Univ. California Publ. Zool., 48:63-148, 6 pls., 12 figs. in text, December 24.

WHITE, J. A.
1951. A practical method for mounting the bacula of small mammals. Jour. Mamm., 32:125, February 15.

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Pleistocene Soricidae from San Josecito Cave, Nuevo Leon, Mexico

BY

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Pleistocene Soricidae from San Josecito Cave, Nuevo Leon, Mexico

By

JAMES S. FINDLEY

Bones of a large number of vertebrates of Pleistocene age have been removed from San Josecito Cave near Aramberri, Nuevo León, México. These bones have been reported upon in part by Stock (1942) and Cushing (1945). A part of this material, on loan to the University of Kansas from the California Institute of Technology, contains 26 rami and one rostrum of soricid insectivores. Nothing seems to be known of the Pleistocene Soricidae of México. The workers cited do not mention them and no shrews are listed by Maldonado-Koerdell (1948) in his catalog of the Quaternary mammals of México. Comparison of these specimens with pertinent Recent material from México, the United States, and Canada leads me to the conclusion that they represent two genera and at least three species. The material examined is described below.

Sorex cinereus Kerr

One right ramus, bearing all three molars but lacking the other teeth and the tip of the coronoid process, needs close comparison only with certain of the smaller North American species of *Sorex*. From *S. merriami* of southeastern Wyoming, it differs in having a shorter, much shallower dentary, a shorter molar row, and a lower coronoid. In every particular it is identical with *Sorex cinereus*. *Sorex cinereus* from northern British Columbia and the specimen from Nuevo León differ from *Sorex saussurei, S. obscurus,* and *S. vagrans* in the ratio of the height of the coronoid to the length of the dentary. This ratio averages 49.6% in *S. cinereus* and 53.0% or more (up to 60.0%) in the other species. *Microsorex hoyi* differs from *S. cinereus* and from the specimen in question in deeper and shorter dentary, more robust condyle, dentary less bowed dorsally, molars shorter in anteroposterior diameter and higher in proportion to this dimension.

This record, as far as I can determine, constitutes a southward extension of the known Pleistocene or Recent range of this species of approximately 800 miles. The nearest known occurrence of *S. cinereus* in Recent times is in the mountains of north-central New Mexico. The species now has an extensive range in boreal

North America and prefers mesic and hydric communities from which it rarely wanders. I know of no instance of the occurrence of the cinereous shrew in desert areas such as there are between many of the mountain ranges of southern New Mexico, Coahuila, and Nuevo León. Therefore, unless the habitat preferences of the species have changed since Pleistocene times, this find constitutes additional evidence that more humid conditions at one time prevailed in the regions mentioned.

Sorex saussurei Merriam

Fragments of three other specimens of *Sorex* occur in the collection. One of these is a right ramus, C. I. T. No. 3943, and is complete except for the canine. The other two bear no numbers and I have designated them "A" and "B." "A" is a left ramus with the dentary broken off anterior to the canine and bears p4 and the canine. "B" is a right ramus bearing m2 and the roots of m3 and is broken off at the middle of the alveolus of m1. Each specimen has certain peculiarities but they resemble one another so closely that I regard all three as of the same species. The teeth, where comparable, are of essentially the same size and configuration. The horizontal rami of the dentaries are the same. The fossils differ, however, in the configuration of the coronoid process. In No. 3943 the coronoid is robust and inclined anteriorly with respect to a line drawn perpendicular to the dentary. The posterointernal ramal fossa (see Hibbard, 1953) is deeply excavated with a distinct superior border approximately halfway between its inferior border and the top of the coronoid. In addition to the mandibular foramen there is a small foramen immediately posterior to it opening into the posterointernal ramal fossa. I shall refer to this as the post-mandibular foramen. The tip of the coronoid is broad, not tapering, and quadrate, and its entire superior border is inclined rather sharply medially. Specimen "B" differs from No. 3943 in that the posterointernal ramal fossa extends nearly to the tip of the coronoid, which is narrower toward the tip and somewhat tapered dorsally. The post-mandibular foramen is large and the opening of the mandibular canal is within the posterointernal ramal fossa. In addition the coronoid does not incline anteriorly. Specimen "A" is intermediate between No. 3943 and "B" in the characters mentioned and differs from both in that the post-mandibular foramen is widely separated from the mandibular foramen.

Comparison of the Pleistocene specimens with specimens of Recent species of North American *Sorex* reveals that the presence or

absence of the post-mandibular foramen is almost constant in any one species. In possessing this foramen the fossils differ from most individuals of the species: *Sorex cinereus, S. pacificus, S. milleri, S. vagrans, S. obscurus, S. ornatus, S. fumeus, S. palustris, S. bendirii,* and *S. veraepacis.* The fossils differ from all these species in other characters as well; consequently detailed comparisons with them need not be made here. Species which possess the post-mandibular foramen include *Sorex saussurei, S. merriami, S. trowbridgii, S. arcticus, S. tundrensis,* and *S. sclateri. Sorex merriami* differs in smaller size, smaller and weaker dentition, relatively higher coronoid, and relatively deeper and shorter dentary. *Sorex trowbridgii* is similar to the fossils and to *S. saussurei.* Differences between the jaws of *S. trowbridgii* and *S. saussurei* seem to me to be differences of size only. *Sorex sclateri* is larger than the fossils and m2 is longer in relation to m1, being almost the same size as m1. In the fossils m2 is noticeably shorter than m1, owing to close appression of the hypoconid and protoconid and in general to a smaller talonid area. *Sorex arcticus* differs in larger incisor and p4. *Sorex tundrensis* differs in relatively narrower molars. I have compared the fossils also with the Pliocene and Pleistocene *Sorex taylori* Hibbard, and find that the fossils are larger and have larger teeth and a much wider separation of the protoconid and metaconid. I can find no significant way in which the fossils differ from *S. saussurei.* This of course implies similarity to *S. trowbridgii.* Since *S. saussurei* is a widespread species in México today and since it occurs in the vicinity of the San Josecito area the specimens under discussion are referred to this species.

Cryptotis mexicana (Coues)

The San Josecito collection contains 22 rami of a species of *Cryptotis.* Many are nearly complete although none possesses the incisor. In addition there is a rostrum that on the right side bears the last two unicuspids, P4, M1, and M2. I have compared these fossils with specimens of the following species of *Cryptotis: C. mexicana, C. magna, C. nelsoni, C. thomasi, C. alticola, C. parva, C. orophila, C. pergracilis, C. guerrerensis, C. obscura, C. mera, C. soricina, C. fossor, C. goodwini, C. griseoventris, C. meridensis, C. mayensis,* and *C. micrura.* The four species first mentioned and the fossils seem to fall into one group. The remaining species fall into another group characterized by a smaller occlusal area of the talonid on all three molar teeth with respect to the trigonid, and

especially by the smaller and weaker talonid of m3 which possesses only one bladelike cusp, the hypoconid. In the first four species the talonids are larger than in the other species when compared to the trigonids, and the talonid of m3 possesses a well developed hypoconid and entoconid with a distinct basin between them. The rami of San Josecito specimens closely resemble those of *C. mexicana* in both size and qualitative characters. The rostrum mentioned above differs from those of *C. mexicana* in that the unicuspids are larger, especially the posteriormost one. *Cryptotis thomasi* and *C. magna* are eliminated from consideration here on geographical grounds. Little difference may be seen between the rami of *C. mexicana mexicana* from Veracruz and *C. nelsoni*. The fossils are referred to the former species since it has a rather wide distribution in México in contrast to *C. nelsoni* which is restricted to Volcán de Tuxtla, Veracruz. The northernmost Recent occurrence of *C. mexicana* known to me is from Las Vigas, Veracruz. As far as I know the species has not previously been recorded from the Pleistocene.

Stirton (1930:225), in summarizing the group characters of Recent Soricidae, listed the bicuspid talonid of m3 as one of the characters of the "*Blarina* group," which includes *Neomys, Soriculus, Notiosorex, Chimarrogale, Cryptotis,* and *Blarina.* That this character does not obtain universally within the group is demonstrated by the unicuspid structure of the talonid of m3 of the majority of the species of Mexican *Cryptotis.*

I am grateful to Drs. David E. Johnson and Henry W. Setzer of the United States National Museum, and to Dr. John Aldrich and Miss Viola S. Schantz of the United States Fish and Wildlife Service for permitting me to examine specimens in their care. Also I am obliged to Professor E. Raymond Hall for permission to study the specimens from San Josecito Cave. The late Professor Chester Stock intrusted the specimens to Professor Hall for study and description.

LITERATURE CITED

Cushing, J. E., Jr.
1945. Quaternary rodents and lagomorphs of San Josecito Cave, Nuevo León, México. Jour. Mamm., 26:2, 182-186.

Hibbard, C. W.
1953. The insectivores of the Rexroad fauna, upper Pliocene of Kansas. Jour. Paleontology, 27:1, 21-32.

Maldonado-Koerdell, M.
1948. Los vertebrados fosiles del Cuaternario en Mexico. Revista de la Soc. Mexicana de Hist. Nat., tomo 9, nos. 1-2.

Stirton, R. A.
1930. A new genus of Soricidae from the Barstow Miocene of California. Univ. California Publ., Bull. Dept. Geol. Sci., 19:217-228.

Stock, C.
1942. The cave of San Josecito, México, new discoveries of the vertebrate life of the ice age. California Inst. Tech., Balch Grad. School Geol. Sci. Contr., no. 361, 5 pp.

Museum of Natural History, University of Kansas, Lawrence, Kansas. Transmitted July 20, 1953.

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E. RAYMOND HALL and WILLIAM B. JACKSON

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Seventeen Species of Bats Recorded from Barro Colorado Island, Panama Canal Zone

By

E. RAYMOND HALL and WILLIAM B. JACKSON

Our aim is to bring up to date the list of kinds of bats actually known from Barro Colorado Island, Panamá. In 1952 Samuel T. Dickenson, Marguerite Schultz, George P. Young, and E. Raymond Hall spent the first 17 days of April (except Mrs. Schultz who left on April 8) on Barro Colorado Island. On eight evenings a silk net, 30 feet long and 7 feet high with a ¾-inch mesh, was stretched in an open place to intercept bats. On the first five nights it was stretched in the laboratory clearing. On April 6 the net was erected in the forest across the Barbara Lathrop Trail 25 feet past its entrance; on the 7th and 8th the net was placed across the Snyder-Molino Trail at the Termite Cemetery, 150 yards southwest of the new (built in 1952) laboratory.

William B. Jackson was on the island from January 30 to June 6, 1952, as a member of a group from the American Museum of Natural History. On May 4 he set the bat net across Allee Creek at the beginning of the Barbara Lathrop Trail, and from May 5 to 27 he set the net in the Termite Cemetery where it was mounted between two small trees with its lower edge approximately 5 feet above the ground. Unless otherwise stated, specimens were caught in this net.

On Barro Colorado Island one aim is to preserve the biota and natural conditions with as little interference from man as possible. Consequently most of the bats captured were released after being wing-banded by Jackson with U. S. Fish and Wildlife Service bat bands; but an attempt was made, with the permission of Mr. James Zetek, Resident Custodian of the Canal Zone Biological Area administered through the Smithsonian Institution, to save one or a few specimens of each species for positive identification. Catalogue numbers are of the University of Kansas, Museum of Natural History, unless otherwise indicated. We are obliged to Mr. Colin C. Sanborn and Mr. Robert J. Russell for checking our identifications of the specimens. Assistance with field work is acknowledged from the Kansas University Endowment Association, the United States Navy, Office of Naval Research, through contract No. NR-161-791, and Mr. James Zetek.

Six species of bats were recorded from Barro Colorado Island by Professor Robert K. Enders in his "Mammalian Life Histories from Barro Colorado Island, Panamá" (Bull. Mus. Comp. Zool., at Harvard College, 78 :383-502, 5 pls., October, 1935). With his list as a starting place we can offer a revised list as follows:

Saccopteryx bilineata (Temminck).—Nos. 45061, 45062, 45097, and 402 and 404 of Jackson. Nonpregnant female No. 45061 captured on April 3 weighed 7.0 grams; No. 45062 captured on April 4 contained one embryo 22 mm. long. It was common to see several bats of this species, not in a cluster but with a few inches of space between any one bat and its neighbors, on the vertical screens that covered the airways beneath the eaves of the buildings. A colony was established in Zetek House (a trail-end house on the western side of the Island), and several individuals often were seen in the Tower House. As many as 50 individuals could be found at the Van Tyne Big Tree (*Bombacopsis Fendleri*) where they hung singly in the shaded inter-buttress spaces and on the exposed trunk sometimes up to a height of 100 feet. Occasionally several individuals would be seen in inter-buttress spaces of large trees on other parts of the Island. These bats were more alert during the daylight hours than were most other kinds of bats and could be approached and captured only with considerable difficulty. From the various colonies 13 females and 3 males were banded.

Noctilio leporinus mexicanus Goldman.—Seen in Wheeler Estuary by Enders (*op. cit.*:416) who uses the subspecific name *N. l. leporinus*. Goodwin (Bull. Amer. Mus. Nat. Hist., 79:121, May 29, 1942) later used the subspecific name *N. l. mexicanus* for this species in Panamá.

Micronycteris megalotis microtis Miller.—Enders (*op. cit.*:417) obtained specimens of this species from the underside of a fallen log and in a hollow tree at marker No. 23 on the Pearson Trail.

Phyllostomus discolor discolor Wagner.—Taken from a hollow tree by Enders (*op. cit.*:417).

Glossophaga soricina leachii (Gray).—No. 45073, April 5.

Carollia perspicillata azteca Saussure.—No. 400 of Jackson taken at Allee Creek and Barbara Lathrop Trail and No. 52456 (410 of Jackson) at Termite Cemetery. These two nonpregnant females weighed 14.7 and 17.7 grams, respectively. Two (♂ and ♀), caught at Termite Cemetery were banded and released.

Carollia castanea H. Allen.—Males, 45080 and 45081, weighed

11.8 and 11.5 grams; at 9:30 P. M., on April 6, on Barbara Lathrop Trail.

Vampyrops helleri Peters.—Male, No. 45095, in net on April 4; weighed 15 grams.

Vampyressa minuta Miller. — Lactating female, No. 45094, weighed 10.0 grams. At 10:30 A. M. at the outer end of the Armour Trail, Young and Hall had barely paused to listen to animal sounds when they saw this bat alight on a breast-high twig of a bush beneath large trees in the gloom of the forest. Possibly it had been disturbed when the zoologists a few seconds before had pushed aside bushes that partly obstructed the trail.

Vampyressa nymphaea Thomas.—Nonpregnant female No. 52455 (403 of Jackson) weighed 10.3 grams and was taken at the Termite Cemetery on May 8. So far as we know, this specimen provides the first record of occurrence in North America of this species which previously had been recorded only from South America.

Chiroderma isthmica Miller.—Male No. 45096, April 2; weighed 13.7 grams.

Vampyrodes major G. M. Allen.—Male No. 45085, weighed 33 grams. It and the one *Chiroderma isthmica* on the morning of April 2 constituted the total catch found in the net stretched in the open clearing between two cabins.

Artibeus lituratus palmarum J. A. Allen and Chapman.—Nonpregnant female No. 45086 taken on evening of April 7, weighed 68.0 grams. No. 401 of Jackson taken on May 6 weighed 53.5 grams and contained one embryo 12 mm. long; his No. 409 taken on May 10 weighed 53.7 grams and contained one embryo 15 mm. long.

Enders (*op. cit.*:418) took specimens of *Artibeus jamaicensis jamaicensis* in Panamá and possibly on Barro Colorado Island; he is not specific as to locality.

Artibeus cinereus watsoni Thomas.—Male No. 45087 on April 8; weight 13.6 grams. Ingles (Jour. Mamm., 34:267, May, 1953) records the finding of as many as three of these bats on the Island in a "tent" that the bats had made of a frond of the palm, *Geonoma decurrens.*

Thyroptera tricolor albigula G. M. Allen.—On May 10 along the Snyder-Molino Trail 50 meters from its beginning Dr. E. R. Dunn found in a curled *Heliaconia* leaf a group of four bats of this species. A lactating female (No. 405 of Jackson), a young male (No. 406

of Jackson) attached to its mother's teat, and a male (No. 407 of Jackson, now 52457 K. U.) weighed, respectively, 4.8, 2.2, and 4.0 grams. The young one remained attached to the mother when she flew about the laboratory. The fourth specimen, a male, was banded and released. These bats with the aid of suction cups on their wrists and ankles hung head up in the rolled leaf and on places in the laboratory on which they alighted. This species was previously recorded (see Enders, *op. cit.*:421) from Barro Colorado Island, on the basis of other specimens also captured by Professor Dunn.

Myotis nigricans nigricans (Schinz).—Nos. 45089-45091 and No. 408 of Jackson. Nos. 45090 and 45091 were plucked from under the eaves of buildings, but No. 45089 was caught in the net on the evening of April 5. Jackson found this species to roost between the corrugations of the metal roof and the underlying wooden supports. He banded 14 individuals, most of which were pulled with forceps from their resting places in the old laboratory or the kitchen. All were males. Five were recaptured from one to 13 days after banding, and two were found in the places from which they originally had been plucked 13 days previously. Enders (*op. cit.*:421) found this species to be abundant about the laboratory where it spent the day hanging under the eaves.

Molossus coibensis J. A. Allen.—Males Nos. 45092 and 45093 weighed 13.9 and 10.0 grams. They were taken in the clearing on April 3 and 5. Enders (*op. cit.*:421) found this bat under the eaves of the laboratory along with *Myotis nigricans.*

On April 19, 1952, Dr. Harold Trapido kindly took Young, Dickenson, Hall, and Dr. and Mrs. E. R. Dunn to the Experimental Botanical Gardens at Summit in the Canal Zone where Nos. 45082-45084 of *Uroderma bilobatum* Peters were saved. On the same date Doctor Trapido took the five of us also to Chilibrillo Cave in Panamá 10 miles north of Pedro Miguel where specimens were saved as follows: *Saccopteryx bilineata* (Temminck), 45059 and 45060; *Phyllostomus hastatus panamensis* J. A. Allen, 45063-45072; *Lonchophylla robusta* Miller, 45074-45075; *Carollia perspicillata azteca* Saussure, 45076-45079; *Natalus mexicanus saturatus* Dalquest and Hall, 45088.

Transmitted July 20, 1953.

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